PAPER TRADE JOURNAL

THE INTERNATIONAL WEEKLY OF THE PAPER AND PULP INDUSTRY AND THE PIONEER PUBLICATION IN ITS FIELD

Established 1886

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SEPT. 22 1938

Vol. CVI No. 12

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TABLE OF CONTENTS

State's $26,000,000 Power Project Deferred .. 7
Business Improving in Charge Territory 8
Syracuse Containers Expand 8
Plan New Study Course for Paper Salesmen 9
Financial News of Pulp and Paper Industry 10
Lake Sulphite Plans Reorganization 10
Sherman Water Power Rights Sold 10
Soundview Increases Profits 10
Niagara Wire Reduces Dividend 10
Now Seaboard Container Corp. 10
Hinde & Dauch Declare Dividend 10
Michigan Superintendents Hold Fall Meeting . 11
Jenkins Corrosion-Resisting Valves 11
The Production of Transparent Papers 12
Robertson Presents Emblems 14
Cantine Co. Celebrates 50th Anniversary 14
Obituary 16
Book for Those Who Live in Year 6939 17
Millar Golf Tournament Held at Elmsford .. 17
Construction News 18
Sturgeon Mill Nears Completion 19
Injured at Paper Machine 19
Government Paper Bids 19
A. M. Eaton Paper Co. Burned 19
Editorial 20
Effect of War on Newsprint Market 21
Delaware Valley Section Officers Meet 21
Production Ratio Report 21
Japanese Paper Production Declines 21
Technical Section
Review of the Paper Industry Literature .. 23
Chemistry of the Alkaline Wood Pulp Processes 24
Bulletin on Hot-Flow Water Softeners 32
Imports of Paper and Paper Stock 33
New York Market Review 35
Miscellaneous Markets 36
Market Quotations 38

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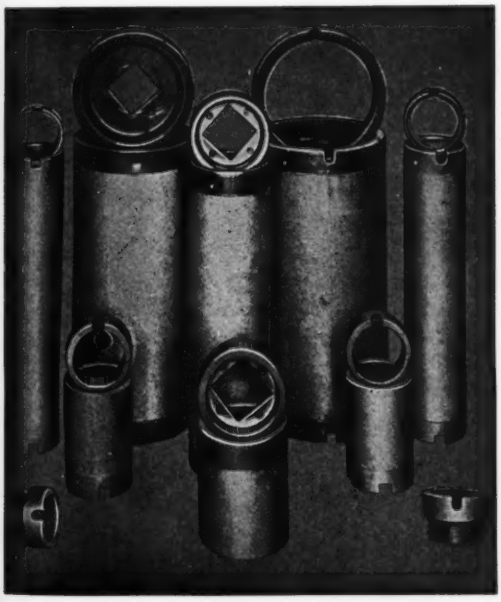

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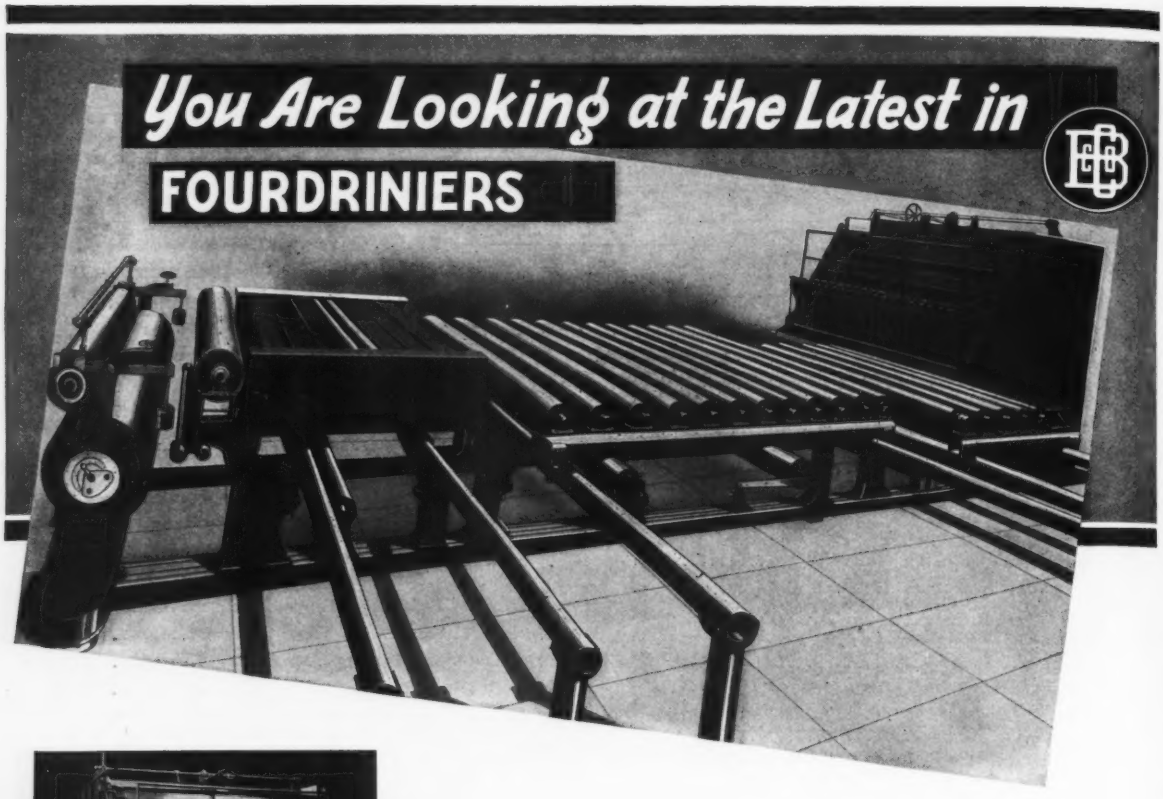

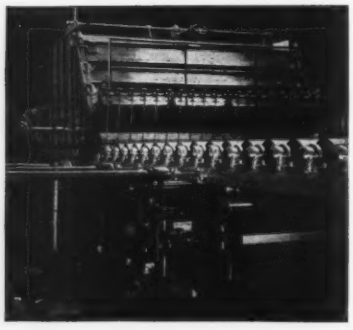

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SIXTY-SEVENTH YEAR

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State's $26,000,000 Power Project Deferred

P.W.A. Administrator Harold Ickes Postpones Action on Proposed Wisconsin Hydro-Electric Development— T. M. Gilbert Addresses Lions Club—Flood Waters Hamper Mills On Wisconsin River—Other News.

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., September 19, 1938—PWA Administrator Harold Ickes at Washington, has sidetracked Wisconsin's proposed $26,000,000 hydro-electric project in favor of smaller developments.

His order said that the Wisconsin allotments to 114 projects resulted from a decision "to allot funds to many projects located throughout the state rather than to one hydro-electric plant." It explained that PWA had failed to obtain from Governor Philip La Follette an indication of local choice between the alternatives.

The Portage county board of supervisors at Stevens Point, Wis., voted, 24 to 4, in favor of a resolution supporting the proposed Fox-Wisconsin power development last week.

I.P.C. Students Study Pulpwood

Eighteen first-year students at the Institute of Paper Chemistry left Appleton last Monday and went into the woods of Northern Michigan.

The young men started a 10-day "bush course" at Camp Filibert Roth, 17 miles west of Iron River, Mich. The students will study pulpwood operations, forest conservation, and wood identification during the expedition.

The students are: Alan Adrian, Appleton, Wis.; William Aiken, Salado, Tex.; Kenneth Arnold, Syracuse, N. Y.; Joseph Atchison, Elk Garden, West Virginia; Robert Berry, Pamdemec, New Brunswick; Cyril Delevanti, Houston, Tex.; Reidus Estes, Winfield, Ala.; Pasquale Forni, Lee, Mass.; William Hulbert, Everett, Wash.; George Ingle, Lynbrook, N. Y.; William Lane Marshall, Tex.; John Redd, Phoenix, Ariz.; Fred Sanders, Little Rock, Arkansas; Willard Schenck, Worden, Mont.; Anthony Urbanic, Cleveland, O.; Lloyd Stevenson, Everett, Wash.

Flood Waters Hamper Mills

The Wausau Paper Company suspended operations of its mill at Brokaw, Wis., September 10, after flood waters of the Wisconsin river had damaged its dam. For a time it was feared that the dam might be carried away. Flood conditions also hampered operations at the Marathon Paper Company mill at Rothschild, Wis.

The Big Eau Pleine reservoir was the virtual center of a cloudburst, and poured immense volumes of water through the gates of its dam. The earth dike withstood the heavy pounding in good shape.

Water near the boilers in the Whiting-Plover Paper Company's mill at Stevens Point, Wis., kept the mill from starting operations on September 12. Cars of coal were stationed on the Soo Line bridge near the mouth of the Big Plover river as a protective measure.

The Fox river also reached its greatest height of the year. The United States engineer's office at Appleton, Wis., reported that gates are open from Portage to Green Bay.

At Nekoosa and Port Edwards, Wis., service and maintenance crews in the mills of the Nekoosa-Edwards Paper Company worked on a 24-hour basis for a time to remove paper stock from flooded basements and to prevent other water damage.

T. M. Gilbert Addresses Lions Club

Development of the paper industry was traced last week in an address by T. M. Gilbert, secretary and treasurer of the Gilbert Paper Company, Menasha, Wis., before the Menasha Lions Club.

It was not the water power which led to the location of paper mills in the Fox river valley but rather the abundance of good water on the alkaline side which is necessary in the manufacture of paper. Old flour mills were first transformed into paper manufacturing plants.

The Gilbert company, established 50 years ago, is one of the oldest in a continuous line of succession. It was founded by William Gilbert after he and George A. Whiting founders of the Gilbert and Whiting plant, had disagreed. Construction of the first plant was haphazard. The plant was designed to be run by water power but there was not sufficient water. A turbine was installed but that also failed. After many delays a large turbine was secured from the East and production started.

The firm, which now produces the largest volume

(Continued on page 17)

Business Improving in Chicago Territory

Midwest Paper Trade Reports Increased and Broader Demand for Many Grades of Paper and Paper Board—Waste Paper Market Reflects Little Improvement—Wagner Act Version In Illinois—Other Late Trade News

[FROM OUR REGULAR CORRESPONDENT]

CHICAGO, Ill., September 19, 1938—Consistent retail buying in this area has as yet not lifted the paper industry out of the even tenor of its ways as reports this week again signify a gradual broadening out of demand and a splendid resistency to any market weakenings. The board market found things a bit more to its liking this week as the top season gradually nears and the strengthening was also reported to be helping the waste paper market to some extent. Ground wood papers were in better demand with prices in good shape while the newsprint market was also slightly improved according to local reports. Books and covers showed a quiet evenness marked by an undertone of improvement all along the line as business gives evidence of improving over a wide front. Bonds and ledgers were little changed, the entire list of sulphites acting favorably according to local representatives. Krafts were but little changed over last week but did report that a much better demand outlook was just in the offing. Waste papers did little to overcome the slight decline of last week and the market is reported locally as "somewhat weak".

Safety Work in the Paper Industry

From the offices of the National Safety Council come reports of some exceptionally productive safety work being carried on by paper concerns in Illinois, Wisconsin and Michigan. Especially is the Council interested in the work of Wisconsin mills at Menasha and Neenah where the major paper making concerns are all identified with constructive safety programs. The Kimberly-Clark Corporation, for example, has reported only six minor accidents for the first six months and these have been of a comparatively trivial nature. The annual safety day was held on August 27 at which time employees participated in inspections, playlets and other measures to promote safety work. The Menasha Products Company has a revamped and very effective safety program which involves monthly inspection trips and which is being watched by some as approaching a "model" procedure. The Bergstrom Paper Company, another organization well aware of the value of safety work, points with pride to only one accident in the past seven months while the Gilbert Paper Company at Menasha is reported by the Council to have had only nine minor accidents of which just two involved an absence from work as compared to 18 accidents and 8 absences for the same period last year.

Other concerns are showing greatly increased interest in well developed safety programs.

Wagner Act Version in Illinois

Preliminary rumblings of the next General Session of the Illinois Legislature indicate that labor will put its full strength behind the enactment of a "baby" Wagner Act for Illinois, behind a five day week, compulsory two weeks' vacations for all workers and similar matters. Compulsory trademark legislation and an unfair practices act are also expected to find their way into the January sessions. Labor is set on the Wagner version for Illinois because of the fact that the Federal Act is reported to not touch the intrastate business interests of Illinois including the retail structure of Illinois. Some amendments to workmen's compensation legislation can also be expected if one follows closely the deliberations of the Illinois Federation of Labor meeting in annual session at Peoria this week.

Soft Ball in Paper Industry

The paper industry had a bit more than ordinary interest in the recent National Soft Ball Championship tournament held in Chicago. One of the teams entered was that of the Eastern Manufacturing Company—the "Eastco's" entered from Brewer, Maine and the champions of the State of Maine. The team was eliminated in one of the semi-final rounds by a California organization but despite the defeat gave a most excellent account of itself.

Syracuse Containers Expand

Syracuse Containers Division of Robert Gair Company, Inc., who are located at Hiawatha Boulevard, Syracuse, N. Y., have under construction additions to their plant which will permit increased business.

The additions to the plant include a new spur track about eight hundred feet long, a new concrete unloading dock, fifteen feet wide by one hundred and sixty-eight feet long, a storage building, fifty feet wide by one hundred and sixty-eight feet long and forty-one feet high, equipped with a travelling crane, and a manufacturing building, twenty-four feet wide by one hundred and sixty-eight feet long, which will connect with the present factory.

The new additions will permit the rearrangement of the equipment now in use and will very considerably increase the capacity of the present plant and will permit a considerable increase in the working personnel.

The excavation foundation and other concrete and masonry work are being done by the Universal Building Construction Corporation of Syracuse, who are also applying the wood deck roof. The transite corrugated building siding and waterproofing for the roof are being furnished and placed by the Smith-Murray Corporation of Syracuse. The electrical work is contracted for by the Salmon Electric Company of Syracuse. The structural steel is furnished by and erected by the Syracuse Engineering Company. The spur track was laid by Frank Tartaglia, Inc., also of Syracuse. The buildings will be equipped with sprinklers by the Automatic Sprinkler Company.

It is reliably reported that about $45,000 is being spent to increase the plant.

Plan New Study Course for Paper Salesmen

Executive Secretary of Paper Trade Association To Announce Details of New Study Course Soon, With Sales Managers of Three Mills On Board of Judges — Paper & Cordage Association Meeting. Other Trade News.

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., September 19, 1938—Doris E. Lewis, executive secretary of the Paper Trade Association of Philadelphia, announces that details of the Salesmen's Study Course will be completed in the next fortnight. Mrs. Lewis pointed out, however, that the course for this year will be conducted on an entirely new line of thought from that of the previous years, and will consist of the best twelve case histories obtainable of sales made of either fine or wrapping paper lines. A board of judges consisting of sales managers from three leading merchants in Philadelphia, Boston and New York, and three leading mill sales managers, whose names will shortly be announced, will select the twelve case histories, after which the mills whose products are represented will be requested to send capable men to present their respective case histories.

Paper and Cordage Association Meeting

One of the most successful and well attended meetings of the Philadelphia Paper & Cordage Association was held in the new Emerald Room of Adelphia Hotel on Friday noon, September 16th. The Membership Committee nominated for membership The Dennison Manufacturing Company, who will be represented at the meetings by W. L. Benson.

The outstanding feature of the meeting was a moving picture illustrating the complete processes of manufacture from tree to paper bag of Union Bag & Paper Company in their modern mills at Savannah, Ga. The picture was shown by Mr. Hawley of the above company and was a revelation even to those men who have been in the paper business all their lives. The manufacturing of paper in these mills is done on such a gigantic scale and under such modern conditions that it was truly an educational picture.

E. K. Lay Presented with Birthday Cake

A very beautifully decorated birthday cake was presented to E. K. Lay, chairman of the Entertainment Committee, and a former president of the Association. Mr. Lay immediately proceeded to cut the cake and very generously served all the members and guests.

The various committees are at work arranging an attractive meeting for the third Friday in October, and plans are already under way for the annual Children's Christmas Party, given annually by the Association to a large group of children from the Salvation Army Settlement Houses.

Scott Sales Well Maintained

Scott Paper Company, in a bulletin to stockholders, states that the favorable sales trend established early in the year continues to be maintained. Net sales for the first eight months of 1938 were 18 per cent greater than in the like period last year.

While company's production in July was not quite up to the peak levels attained earlier in the year, August showed an improvement and enabled the company to make some progress in reducing the heavy volume of unshipped orders on file.

Sample Book for the Trade

Paper Manufacturers Company, Inc., Philadelphia, have in the course of preparation a new sample book containing seventeen helpful hints to the trade, so indexed that ready reference can be made among other interesting features, to "Pointers", and "Facts About Flatness." Featured in this new sample book will be samples of Dextrine and Strong Gumming in their complete line of white and colored gummed papers. Suggestions with grade numbers are given to aid in the selection of the proper gumming and printing surface, with complete explanation of same.

Full information on weights of white and colored stock, roll widths for special sizes, etc., is set forth. The Perfection sample book when folded will be a handy pocket size, 8½ x 5¼ inches, with a cover of attractive bright red and royal blue,—these being the trademark colors for Perfection Gummed Papers. When opened the book measures 8½ x 16 inches.

If you have a good product, "tell the world about it" is the slogan of Paper Manufacturers Company, Inc.

Robert Gair Employees Have Outing

The fourth annual outing of the employees of Eastern States Carton Division of Robert Gair Company, Inc., was held at Massapequa Park, L. I., on Saturday, August 27, 1938. Over 100 employees and guests assembled at the Park for the day's festivities. Lunch was served. The main attraction of the day was a ball game between the employees of the Piermont Division of Robert Gair Company, Inc., and Eastern States Carton Division, for a silver cup jointly presented by Alexander Israel and Norman Greenway, managers of the two plants. The cup represented the baseball championship of 1938. The spirited game was called at the seventh inning because of darkness and showers, with Piermont leading 3 to 1. In the spirit of sportsmanship, Piermont refused to accept the cup because the game was not concluded. Other events and dancing were conducted indoors with many cash prizes awarded. Among the numerous guests were: Mr. and Mrs. L. H. Gaetz, Lee Moss, J. A. Dittrich, Norman Greenway and Mr. John Pabst.

As a sequel to the outing, the final baseball game between Eastern and Piermont was played on September 10, at the Sparkill Ball Field, Sparkill, N. Y. Under conditions favorable to both sides, the Piermont team became the possessor of the silver cup by a score of 10 to 6.

Financial News of Pulp and Paper Industry

Lake Sulphite Pulp Plans To Reorganize—Water Power Rights of Sherman Paper Co. Sold — Soundview Pulp Co. Reports Greater Profits — Niagara Wire Reduces Its Dividend — Hinde & Dauch To Pay 25 Cents.

NEW YORK STOCK EXCHANGE

High, Low and Last for the Week Ending September 21, 1938

	High	Low	Last
A. P. W.	2¼	2¼	2¼
Armstrong Cork Co.	43½	39	42½
Celotex Corp.	23	19⅞	22⅝
Celotex Corp., pf.	62⅛	62⅛	62⅛
Certain-Teed Products Corp.	9⅞	7¾	9⅜
Certain-Teed Products Corp., pf.	37½	31	37
Champion Paper & Fibre Co.	24⅜	21	24⅜
Champion Paper & Fibre Co., pf.	95¾	95¾	95¾
Congoleum-Nairn Co.	25½	22½	25½
Container Corp. of America	14⅝	11½	14¼
Continental-Diamond Fibre Co.	8½	7	8½
Crown-Zellerbach Co.	12	9¾	11⅞
Crown-Zellerbach Co., pf.	78	77½	77½
Flintkote Co.	23⅝	20⅜	23⅛
Robert Gair	4⅛	3½	4
Robert Gair, pf.	12⅞	12⅞	12⅞
International Paper & Power	8⅞	6⅞	8½
International Paper & Power, pf.	38½	32	37⅛
Johns-Manville Corp.	98½	90⅛	97
Johns-Manville Corp., pf.	128	128	128
Kimberly-Clark Corp.	24⅛	24⅛	24⅛
Masonite Corp.	54½	50	53
Mead Corp.	12¼	10⅜	12¼
Paraffine Companies, Inc.	46½	43	46½
Ruberoid Co.	27½	24	26
Scott Paper Co.	47	45¼	47
Sutherland Paper Co.	29	27¾	29
Union Bag & Paper Corp.	12½	10¼	12¼
United Paperboard Co.	6⅜	5¼	6⅛
U. S. Gypsum Co.	99⅜	94	98

NEW YORK CURB EXCHANGE

High, Low and Last for the Week Ending September 21, 1938

	High	Low	Last
American Box Board Co.	9	8¾	9
Brown Co., pf.	20	17½	20
Great Northern Paper	29¼	29¼	29¼
St. Regis Paper Co.	3	2½	2⅞
St. Regis Paper Co., pf.	54	54	54
Taggart Corp.	4¾	4⅜	4½

Lake Sulphite Plans Reorganization

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., September 19, 1938—The Lake Sulphite Pulp Company, Limited, Red Rock, Ont., which went into liquidation some months ago and is at present in the hands of a receiver, G. S. Currie, Toronto, has plans under way for reorganization, according to John Stadler, President of the company. Progress on construction broke down seven months ago when the company ran out of money after spending five million dollars on the big plant. It is understood that about a million and a half dollars is required to complete construction. Steps now under way will not be completed until November or later, the mill has been geared to produce both bleached and rayon sulphite. The prices of the latter are favorable but bleached sulphite has weakened in value. It is reported that production may be rayon sulphite one week and bleached sulphite the next. Mr. Stadler refused to disclose what interests were involved in the proposed reorganization of the Lake Sulphite Pulp Company, which was originally capitalized at three million dollars. There the matter rests at present until further details are revealed.

Sherman Water Power Rights Sold

[FROM OUR REGULAR CORRESPONDENT]

GREAT BEND, N. Y., September 19, 1938—The water power rights of the defunct Sherman Paper Company have been purchased by the Central New York Power Corporation. Negotiations for the purchase were carried on through the Anderson Land Company which recently assumed control of the holdings of the bankrupt concern. An official of the power company stated that he could not tell what will be done with the power rights. The price paid was not disclosed but it was understood to be in the neighborhood of $200,000. The amount of potential and developed power will not be definitely known until engineers complete the survey they have been making. The power is located at the Felts Mills, Great Bend and Lefebvre mills of the paper company. The mills were sold some time ago separate from the water power rights and were purchased by a Syracuse contractor, who is demolishing them. It was indicated that any development of the power rights by the new owners will depend largely upon business prospects. It was stated that the newly acquired rights will fit in nicely with the other holdings of the concern on the Black River between Carthage and Watertown.

Soundview Increases Profits

The Soundview Pulp company reports August business jumped so that sales totaled 8336 tons of pulp compared with 6164 in July, and operating profit to $26,513 from $11,408. Production went up to 4953 tons from 4810.

In August last year production was 14,741 tons, the second highest month in the company's history. Sales were 11,406 tons and operating profit $262,269.

Niagara Wire Reduces Dividend

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., September 19, 1938—Drop in the earnings of the Niagara Wire Weaving Company as a result of lower newsprint production by its chief customers is reflected in the fifty per cent reduction in the quarterly dividend rate. The company has just declared a dividend of twenty-five cents per share as compared with fifty cents per share which has been paid since April, 1937.

Now Seaboard Container Corp.

All outstanding stock of the National Container Corporation of Pennsylvania has been purchased by Fredric R. Mann and A. L. Rosenfeld. To avoid any confusion, the National Container Corporation of Pennsylvania will change its trade name to the Seaboard Container Corporation. There will be no change in the management.

Hinde & Dauch Declare Dividend

TORONTO, Ont., September 19, 1938—The Hinde & Dauch Paper Co. of Canada, Limited, Toronto, have declared a dividend of twenty-five cents a share on the common stock of the company for the last quarter.

Michigan Superintendents Hold Fall Meeting

KALAMAZOO, Mich., September 19, 1938.—The first fall meeting of the Michigan Division of the American Pulp and Paper Mill Superintendents' Association, was held at the Park American Hotel on Thursday evening, September 15, with forty present. Following the dinner, Chairman Dan Stacy opened the meeting and after greeting the members and guests called on National President R. L. Zelles who addressed the meeting. He outlined the tenative plans for the association during the ensuing year, stating that an intensive drive to increase the membership was one principal aim. He commented on the cooperative spirit prevailing between the Technical Association and that of the Superintendents, and that same condition which exists between their association and the management of the various mills. He announced that W. E. Odum of Odum Associates, would be the speaker at the October meeting and all mill executives would be invited and urged to attend.

Candidates Nominated

Homer E. Stafford chairman of the Nominating Committee announced the following names as candidates for officers of the Michigan Division for 1938-39. Chairman, Ray L. Barton of the Michigan Paper Company, Plainwell; first vice chairman, L. H. Laliberte of the Kalamazoo Vegetable Parchment Company; 2nd vice chairman, Arnold Weller of the Sutherland Paper Company; secretary-treasurer, A. L. Perlick of the K. V. P. Company. Their unanimous election followed and each one responded with brief remarks.

J. W. Joslyn Guest Speaker

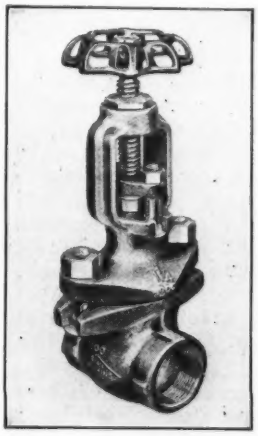
The guest speaker for the meeting was J. W. Joslyn of the Sandy Hill Iron and Brass Works. Mr. Joslyn's address was augmented with two films showing the manufacturing operations and setting up of the Kamyr machine, and the second one showing the Bertram Sandy Hill Shake in operation on a machine. He also had a miniature working model of the Shake which created much interest. In addition to these he showed a film showing the Paper Making Laboratory of the University of Syracuse, a feature meeting with marked approval by those present. Mr. Joslyn then discussed the merits of the Sandy Hill Flow Distributor in which he answered innumerable questions put to him by the Supers. A general forum followed in which questions on the three products were answered and explained—all very interesting and instructive. Those present at the meeting were:

Those in Attendance

F. H. Zellers, French Paper Company; Ray L. Barton, Michigan Paper Company; Dan Stacy, American Box Board Company; J. W. Joslyn, Sandy Hill Iron and Brass Works; Al Perlick and L. H. LaLiberte, Kalamazoo Vegetable Parchment Co.; P. W. Bartholomew, Hercules Powder Company; L. J. Scheid, Watervliet Paper Company; Al Sherwood, Sutherland Paper Company; A. E. Bachmann, Missisquoi Corporation; Paul de Guehery, Michigan Paper Company; A. E. Montgomery and H. E. Warman, J. O. Ross Engineering Corporation; L. L. Griffiths, Jr., Heller & Merz Company; James A. Wise, Kalamazoo Paper Company; Willard Barnhart, American Box Board Company; Glen Sutton, Sutherland Paper Company; William Astle, Michigan Paper Company; H. E. Stratton, PAPER TRADE JOURNAL; William Costello and Joe Loughead, Jos. E. Loughead Company; Arnold Weller, Sutherland Paper Company; O. F. Parker, Strans-Stafford, Inc.; C. F. Sisson, Mac Sim Bar Paper Company; A. E. Woollam, A. E. Woollam Company; Merton S. Fogerty, Michigan Paper Company; H. K. Vinton, PAPER TRADE JOURNAL; J. G. Wright, Jr., A. M. Meincke & Son, Inc.; B. A. Yule, F. C. Huyck & Sons; H. C. Bradford, Rex Paper Company; A. B. Milham, Bryant Paper Company; L. H. Breyfogle, Draper Brothers Company; Nooman J. Cowie, Hawthorne Paper Company; Homer E. Stafford, Retired—Park-American Hotel; L. M. Mongrieg, U. S. Rubber Products, Inc.; John Cornell, *The Paper Mill*; Joseph Ely, Peninsular Paper Company; S. V. Cottrell, National Aniline and Chemical Co.; J. F. Carrigan and C. E. Wurtz, French Paper Company; L. E. Fitzgerald, Hercules Powder Company; O. F. Fischer, Bryant Paper Company.

Jenkins Corrosion-Resisting Valves

Jenkins Brothers are introducing an advanced line of corrosion-resisting stainless steel valves. By "Corrosion-Resisting Stainless Steel," is generally meant some combination of chromium and nickel with small additions of silicon, molybdenum, copper, columbium, titanium, etc., the balance being iron. The expression, "18-8," for example, refers to an 18 per cent chromium and 8 per cent nickel content.



These new Jenkins Valves are regularly made of Cooper 18-8 S and Cooper 18-8 SMO, each having a carbon content limited to a maximum of .10 per cent (1/10 of one per cent). Both are highly resistant to corrosion, but Cooper 18-8 SMO is used under most severe conditions and is particularly adapted to sulphite pulp mills. It is safe to state that these two alloys will take care of almost ninety per cent of all corrosion-resisting requirements. In cases where neither of these valves can be recommended, valves of other alloys will be considered on special order.

They are available in 7 different styles:—solid wedge or double disc Gate Valves, union bonnet or bolted bonnet Regrinding Globe or Angle Valves, and bolted bonnet "Y" Valve; all either screwed or flanged, in sizes ½ to 3 inches.

The Production Of Transparent Papers

By John H. Holzberger [1]

One growing market for the paper industry today is the so-called "window envelope." Here a separate piece of transparent paper is glued into the face of the envelope, covering an open space provided for the purpose. The address on the letter enclosed shows through clearly. The envelope has the advantage not only of eliminating a separate addressing (a time-consuming process where out-going correspondence is voluminous), but further of obviating the possibility of errors or of illegible addresses due to dampness or other causes.

The chief objectives in the preparation of such a unit are good transparency, durability of the treated material, a glossy surface finish, the proper consistency of flow to conform with plant practice, and finally, production at an economic or low cost.

Question Chiefly of Penetration

Transparency becomes a question chiefly of penetration of certain materials into the pores of the treated paper. If a wax or an oil be dropped onto a paper, or the latter dipped into such substances, penetration is sufficient to transmit light and may even permit one to see through the paper. A straight paraffin wax may, with heat, give the desired result in this direction. It will not, however, provide a glossy finish nor necessarily an even surface, and further, entails a more complicated process of manufacture. Other materials producing transparency retain a certain tackiness and are sticky, making them unsuitable for the application under discussion. The ideal combination must dry quickly and completely, leave a smooth glossy surface, penetrate the fibres of the paper to so great a degree as to permit one to read any type clearly through it.

Any method of making transparent paper must be adapted to machine operations involving either dipping of the paper or coating it completely by means of rollers, or coating only small desired areas as by a printing pad or a roller with a section of its surface depressed. The transparency may be achieved by coating one or both sides of the paper. In general, the latter type of operation involves a number of factors which make the procedure more difficult. The viscosity of the coating medium is, however, important. It must be heavy enough for printing press operations, yet retain sufficient flow to accomplish the smooth finish desired.

A treating solution for the economic manufacture of such transparent sections in "window" envelopes using natural resins has been developed in the research laboratory of the American Gum Importers Association, Inc., in response to a request. The experimental work followed in this connection may be of interest to others having the same or similar problems. Its details may save time in plant experimentation and "trial and error" methods, or may suggest ideas adaptable in procedures already established.

The Most Logical Resins

From a knowledge of the solubilities and the characteristics of all of the natural resins, and the data collected by the American Gum Importers Association, Inc., the most logical resins were considered to be the damars which are petroleum and coal tar solvent soluble, and the Manilas and Sandarac which are alcohol soluble. The Congos and kauris were specifically omitted because of their characteristic insolubility in most cheap materials. Another limiting factor is the color of the solution produced. Mixtures giving dark colors are undesirable; colorless solutions, or those nearly so, are demanded.

As a representative of the damar group meeting specifications, Batavia Damar A/E was combined with toluol. Manila Loba "A" (one of the copal type), Sandarac, and Singapore Manila White Split Chips were each dissolved in Solox, a denatured alcohol; while a fifth solution was made of Elemi in an ester, butyl acetate. Elemi is itself too tacky, but was included in the preliminary experiments as a type, to indicate possibilities or to be rejected immediately. The representative solvents were chosen chiefly with the idea of economy, although other similar materials may be substituted with similar results. The proportions in the first tests were 20 parts of resin to 80 parts of solvent, making a 20 per cent solution.

A separate sheet of a good grade of paper, suitable for envelope manufacture, was dipped into each of these solutions and allowed to dry. None of the resins made the papers transparent, although they were translucent. The Batavia Damar A/E in toluol and Singapore Manila White Split Chips in Solox gave the most translucent results. These two, then, were chosen for further treatment. They indicated a possibility of clearing through a mixture of other solvents.

Using the 20 per cent Batavia Damar A/E in toluol and Singapore Manila White Split Chips in Solox, tests were made with the addition of various oils and of dibutyl phthalate, the latter one of the most widely used of the plasticizer group. These are shown in solutions 1, 2, 3, and 4 in Table I on the following page.

The manner of application of these solutions was the same as in the previous experiments. Solution 1 gave fair results in translucency; solution 2 was good; solutions 3 and 4 were poor and were discarded. The product of 20 per cent Batavia Damar A/E-toluol solution mixed with mineral oil in the ratio of 30:1 (solution 2) showed definite promise, warranting further work in this direction.

Drying and Penetration Properties

Consideration was now given to drying and penetrating properties of the materials used. Benzol, in comparison with toluol, has a lower boiling point, shows greater penetration into the paper, and therefore will evaporate faster. A substitution of benzol for toluol in the original solution of Batavia Damar A/E appeared of interest. A 20 per cent solution was so made. Mineral oil was then added to give test samples with the ratio of resin to oil 6:1, 6:2, 6:3, and 6:4.

Applied to both sides of sheets of paper, all four

[1] American Gum Importers Association, Inc.

TABLE I

Material	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
20% Batavia Damar "AE"-Toluol ..... Solution No.	30	30																
20% Batavia Damar "AE"-Benzol	"	"	"	"	30	30	30	"	30	30	30	30	30	30	30	30	30	30
50% Batavia Damar "AE"-Benzol	"	"	30	30	"	"	"	30	"	"	"	"	"	"	"	1	"	"
20% Singapore Manila White Split Chips-Solox	"	"	"	"	"	"	"	"	"	"	"	"	1	"	"	"	"	"
Butyl Lactate	"	"	1	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
Castor Oil No. 15 (processed)	"	"	"	1	"	"	"	"	"	"	"	"	"	"	"	"	"	0.10
Dibutyl Phthalate	"	"	"	"	"	"	"	"	"	"	2	2	2	"	1	"	"	"
Drier	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1
Ethyl Acetate	"	"	"	"	"	"	"	"	"	"	1	"	"	"	1	"	1	2
Linseed Oil (5 hr. kettle bodied)	"	1	"	"	1	1	1	2	2	2	"	"	"	2	1	2	2	"
Mineral Seal Oil	"	"	"	"	"	1	1	"	2	1	"	"	"	"	"	"	"	"
Octyl Acetate	"	"	"	"	0.5	"	0.5	1	"	1	"	"	"	"	"	"	"	"
Paraffin Wax	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
Torch Oil (B. P. 266°-393° C.)	1	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
Translucency	Fair	Good	Poor	Poor	Good	Good	Good	Fair	Good	Poor	Fair	Fair	Fair	Fair	Fair	Good	Good	Good
Transparency	"	"	"	"	Fair	Fair	Fair	Fair	Good	Poor	Fair	Fair	Fair	Good	Fair	Good	Good	Good
Penetration	"	"	"	"	"	"	"	None	Good	None	Good	Good	Good	Good	Good	Good	Good	Good
Gloss Film	"	"	"	"	"	"	"	Fair	Good	Poor	Fair	Fair	Fair	Good	Fair	Good	Good	Good
Readability *	"	"	"	"	"	"	"	"	Slight	Slight	Slight	Slight	Slight	None	Slight	None	None	None
Tackiness	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

* The term readability used in the above table is explained as follows: The sheets of paper with the solutions on them were placed over a typewritten sheet, and depending upon the sharpness of the type when viewed through the treated papers, the "readability" was classed as Poor, Fair or Good.
Figures indicate "parts by weight."

ratios produced translucent materials. The first two dried thoroughly, but those with the greater quantity of oil (6:3 and 6:4) remained tacky.

Even with the mineral oil in ratios of 6:1 and 6:2 resin to oil, the desired degree of penetration of the resin into the paper had not yet been reached. Auxiliary penetrants were included in the next series of samples, solutions 5, 6, and 7 in the table. These solutions were flowed onto both sides of sheets of paper and allowed to dry. They did not, however, show any improvement in penetration or transparency; the papers were merely translucent.

A series of more concentrated damar solutions followed, in combination with the oil and additional aids. Their compositions and results are numbered 8 through 17 in the table. The best results were obtained with solutions 14, 16, and 17.

Another Possible Combination

Another possible combination that produced very good readability and penetration when flowed onto both sides of the paper consisted of the following:

30 parts damar solution made of 15 parts of Batavia Damar A/E and 15 parts of benzol
1 part five-hour kettle bodied linseed oil
2 parts octyl acetate
0.10 part drier (12 parts soluble lead drier, Pb 24 per cent by weight; 2 parts soluble cobalt drier, Co 6 per cent by weight; 1 part soluble manganese drier, Mn 6 per cent by weight)

Either solution 16 or the formula given above may be satisfactorily used in the treatment of paper for the manufacture of "window" envelopes. These solutions should be applied to both sides of the paper, as stated throughout the study, either by dipping or by flowing on each side. In operation, the materials, will be found thin enough to flow on readily, yet thick enough to apply by printing press methods.

The method of application—namely, flowing—used throughout the tests might not be applicable to the manufacture of window envelopes on a commercial scale by printing press methods, due to the fact that the treated portion would have to be restricted to a space of approximately 1½ x 3 inches. The ideal method of application would be by means of a press fitted with either stamps or rollers. In this process, the stamps or rollers could be coated with the solution and from these transferred to the paper.

In the laboratory, an attempt was made to simulate the proposed process. Solution 16 and solution 18 were made and it was found that they possessed viscosities of A—(.50—poise in absolute units) on the Gardner-Holdt scale. It was thought that these solutions were too low in viscosity for the proposed printing method. Solutions 16 and 18 were remade in the same proportions, but a 70 per cent Batavia Damar A/E-benzol solution was substituted for the 50 per cent Batavia Damar A/E-benzol solution previously used. Solutions 16 and 18 now had viscosities of P- and Q (4.00- and 4.35 poises in absolute units) respectively.

Two flat discs were dipped into the solution to be tested so that one surface of each disc was coated. These discs were placed directly opposite each other, one on each side of a sheet of paper. These discs when not pressed too firmly gave a round spot. The treated papers were allowed to dry. Upon examination it was found that all four solutions gave very good results. The penetration of all of them was very good, although the materials containing 70 per cent

Batavia Damar A/E-benzol solution required a little longer time to penetrate thoroughly. The gloss and readibility of all were excellent. Contrary to the supposition that the solutions of A- viscosity would run, it was found that if an excess of the solution is not applied to the stamp, the spot produced will be restricted to the size of the disc used for printing.

Simple and Cheap Methods Suggested

Simple and cheap methods for the preparation of transparent paper are suggested. One preparation proposed for this use contains damar resin in a coal tar solvent with a small amount of a drying oil and a penetrant. Another suggested formula (No. 16) contains damar resin in a coal tar solvent with butyl lactate and octyl acetate. The products produced by these treating solutions should be of use to those in the paper industry who desire paper materials which are to be made transparent in their entirety or in part, as in the case of "window" envelopes.

Robertson Presents Emblems

The Eighth Annual Outing of the Robertson Paper Box Company, Montville, Conn., was held September 10, on the shores of beautiful Gardner Lake. A surprise feature of the outing was the presentation of Service Emblems to seventy-nine men and women who have been with the company for periods ranging from five to thirty-five years. The presentation was made by Ralph A. Powers, president, who spoke in part as follows: "It now becomes my pleasant privilege to present service emblems to all of you who have been with our company for five years or longer. Our emblem plan has been worked out on a basis of five years or multiples of five. For example, anyone with the company from five to nine years inclusive, receives a five-year emblem—from ten to fourteen years inclusive, a ten-year emblem. And so on up the ladder of time. As employees progress from one time-group to another, it is expected that additional emblems will be awarded. These emblems are of gold and enamel and should last a lifetime. Wherever you wear them, they will stand as a symbol of the mutual goodwill that exists between the company and you."

James B. McFarlane, the dean of Robertson employees, received a 35-year emblem; C. Alfred Johnson and John Chop, 25-year emblems; Mike Malinowsky, Mark T. Furber, and Mrs. Irene Mitchell, 20-year emblems. In addition, ten 15-year, twenty-eight 10-year and thirty-five 5-year emblems were presented. Harry W. Schwartz, production manager of the company, made the presentation talk which accompanied the award of a 15-year emblem to Ralph A. Powers, president.

The sports program which preceded and followed the emblem episode included the traditional soft ball battle between Capt. Harry Bell's Box Factory "Tigers" and Capt. Ollie Messner's Board Mill "Wildcats"—won by the "Tigers," who now lead in the series five to three. Capt. "Toots" Boska's single ladies' soft ball team triumphed by the close score of nine to eight over Capt. Ethel Rice's married ladies' team in a hotly-contested match. Winners in the four boxing bouts, refereed by Louis Schafer of the New London Y. M. C. A., were Theodore Allen, W. Waligurski, Tony Malinowsky and C. Fox.

The balloon blowing contest for men and women was won by Ted Allen, for boys, and girls by A. Walensky. The sack race for women was won by Rita Allen. Other prize winners in races and games for men, women and children were Sophie Daniels, John Kotula, Loretta Callahan, Toots Boska, Nick Lewitz, Rita Allen, Gilbert Costello, Arthur Paradise, Sophie Tyrseck, Doris Phillips, Albert Taylor, Jr., Lester McKinney, Jr., James Sarayusa, Jr., John and Josephine Ywarsky.

Music was furnished by the Robertson Hillbilly Band (The Arkansas Travelers), featuring Jack Ywarsky, guitar, and Walter Ywarsky, singer.

On the committee in charge of the Outing were Harry Bell, Ollie Messner, Elsa Rorick, and Harry Schwartz.

Cantine Co. Celebrates 50th Anniversary

One hundred and nine paper merchants from all over the country attended the 50th anniversary celebration of the Martin Cantine Company which was held last week at the Woodstock Country Club in Woodstock, N. Y.

The delegates presented a handsome ship's clock, "guaranteed for another 50 years," to Holley R. Cantine, president of the company. The presentation address was made by J. O. Bulkley, of Bulkley, Dunton & Co., who have been distributors of Cantine's coated papers for nearly 50 years.

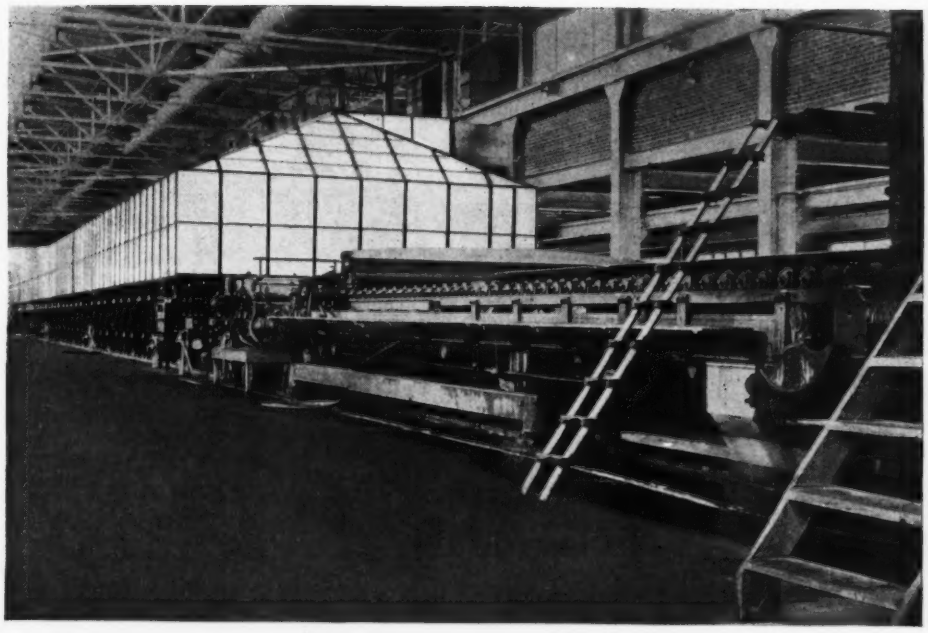
Charles Walden, publisher of *Printing Magazine*, presented to Mr. Cantine a handsome portfolio which contained a letter from every Cantine distributor in the country. Many of the sentiments expressed in the letters were repeated from the floor, where delegates rose impromptu to tell incidents from the past which had contributed to the extraordinarily high regard in which the company has always been held.

Oswald Marquardt, past president of the National Paper Trade Association, presented a birthday cake of a size and quality that appears only about once in fifty years.

Lewis F. Fellows, treasurer, traced the history of the company, dwelling especially on the four great personalities who had dominated the organization—Martin Cantine, founder; James Dederick, treasurer; Henry Dickhaut, superintendent; Wm. R. Crump, in charge of sales. All these men are now gone, but their policies and methods live through the men they personally trained to follow them.

The guest speaker was W. A. McDermid, sales counselor of New York, and several times president of the Association of National Advertisers. Mr. McDermid, after reviewing the record of business failures (about 20 per cent per annum), made a summarized analysis of the factors of success—particularly as applied to the Martin Cantine Company. Pioneering and priority, he said, gave a flying start in coated papers, but were no guarantee of success; neither, necessarily, was high quality of products—which is striven for, and largely attained by most manufacturers in all lines. Major factors were: the integrity, character, and enlightened unselfishness of the founder and his successors; consistency and continuity of effort in manufacture and sales; and flexible capacity to keep in step with the times and to meet soundly the economic changes of half a century, through known brands, definite sales policies, service in all transactions, quality, price protection within the law, selective distribution, territorial protection and progressive research.

ANOTHER BELOIT MACHINE



THIS FINE PAPER MACHINE IS THE PRODUCT OF THE MODERN ENGINEERING AND MANUFACTURING FACILITIES WHICH MAKE BELOIT THE LEADER IN MEETING THE EXACTING DEMANDS OF THE PAPER INDUSTRY

THE BELOIT WAY BELOIT IRON WORKS PAPER MACHY BELOIT, WIS. U.S.A. **IS THE MODERN WAY**

Obituary

Percy D. Wells

Percy D. Wells, 67, widely known and highly regarded in the paper industry, who had conducted a business of his own in Boston for the last 20 years, died suddenly at his residence, Belmont, Mass., September 15.

Mr. Wells started in the paper business with the Messinger Paper Company, Chicago, in the nineties. Later he was with the Butler Paper Company, Chicago, in the late nineties and then with the Alling & Cory Company, Rochester, N. Y. Still later, he opened the first office for the Whittaker Paper Company in Detroit. From that city he came to Boston to be with the Bay State Paper Company, as subsidiary of the Whittaker Paper Company. Subsequently, he was associated with Tileston & Hollingsworth, Boston, remaining with that concern about ten years. About 1920, he established his own business under the name of Percy D. Wells. At the time of his death, his office was at 150 High street.

For some time he was actively interested in the Royal Arch Chapter of Masons, Belmont, and was also a member of the Order of the Mystic Shrine, Aleppo Temple.

Besides his widow, Mrs. Augusta (Cowell) Wells, a daughter, Mrs. Alfred M. Barnard, and two grandchildren, of Belmont, are living.

Funeral services were held September 17 in All Saints Episcopal Church, Belmont. Burial was in Cambridge Cemetery.

Carl L. Pfeifer

Carl L. Pfeifer, Treasurer of the Chain Belt Company, Milwaukee, Wis., died suddenly, August 24th in Philadelphia, Penna. He had left Milwaukee the day before for Philadelphia on business and was stricken upon his arrival there.

Mr. Pfeifer was born in Chicago, Illinois in 1880, where he received his education. In 1914, he was employed by the Chain Belt Company as comptroller after leaving the employ of Arthur Young & Company. In 1916, Mr. Pfeifer was elected Treasurer of the Chain Belt Company, a position which he held until his death.

Mr. Pfeifer was at one time director of the National Association of Cost Accountants and the Controllers Institute of America in which organizations he was very active. For a number of years he was connected with the Milwaukee Goodwill Industries and was active in other charitable work throughout Milwaukee.

He is survived by his widow, a daughter, and two sons, G. Herbert with the Chain Belt Company, and C. Lowell, an instructor at Marquette University.

Nathan Braver

Nathan Braver, 49, president of Braver, Healey & Company, Roxbury (Boston), Mass., dealers in paper stock and box board, died September 15.

Mr. Braver was born in Russia, December 25, 1889, and came to this country when 11 years old, living in South Boston. Later he became a partner in the firm of A. Braver & Son in the paper stock business. In 1924, the present company was formed, with Mr. Braver as president and Henry Shuman as a member of the firm.

Mr. Braver, whose residence was at 124 Wellington Hill, Mattapan, was highly regarded by all. He was a member of Temple Lodge of Masons, Boston; King Solomon Lodge, K. of P.; B'Nai Brith; Dorchester Zionists; treasurer of the Dorchester Mattapan Branch of Temple Israel Religious School, and a member of the Temple Mishkan Bafula, Roxbury.

There are living his widow, Mrs. Jennie Braver; a son, Martin, 15; and two daughters, Sylvia, 15, and Elayne, 3.

Edwin Garrett

Funeral rites for Edwin Garrett, well known general paper merchant, and head of Edwin Garrett & Sons, Chester, Pa., who died at his home, 230 East Second street, Media, on September 12, were held at the Providence Friends' Meeting House, Media, on Thursday afternoon, September 15.

Prominent speakers in the Society of Friends, who had intimately known Mr. Garrett, paid him high tribute. Interment was in the burying ground adjoining the meeting house.

Mr. Garrett had been engaged in the paper business for 52 years, and he supplied many merchants throughout the country with paper bags and wrapping paper.

Mr. Garrett was held in high esteem by all with whom he came in contact; he was exceedingly conscientious in business and with friends and retained their friendship. He was ill but one week. Mr. Garrett is survived by his widow, Bell Hoopes Garrett of Media, a daughter, Mrs. Lewis Hughes Kirk of Drexel Hill, and a son Edward Garrett of Swarthmore.

A. O. Mortenson Goes With Union Bag

Alfred O. Mortenson has recently been appointed by Union Bag & Paper Co., assistant to that well-known pulp and paper maker, who has done so much for the industry in the South, Ed Mayo. Mr. Mayo has been with Union Bag for the past two years or more as production manager at Savannah.

Mr. Mortenson brings a fund of general pulp and paper making knowledge to his new position. He has spent twenty-seven years in the industry. His most recent former connections were with the St. Regis Paper Company, the Gilman Paper Company, and the Brown Company of Berlin, N. H. He served them in various capacities ranging from outside electrical construction foreman to plant engineer. Prior to his recent appointment he served Union Bag as electrical engineer in charge of the electrical detail connected with their expansion at Savannah, and since the first of the year, or since the close of construction, he has been their assistant superintendent of power. In his early days Mr. Mortenson was with the International Paper Company, the Wayagamack Pulp and Paper Company, the Great Northern Paper Company and others as a pulp and paper maker. His early training took him into all departments connected with the plants in which he worked and now assists materially in fitting him for his new position. His many friends wish him well in his new undertaking.

Book for Those Who Live in Year 6939

Here's a new high in permanence! Ink and paper to last 5000 years are required in the production of a special "time resistant" Book of Record being prepared for the edification of whoever inhabits the earth in the year 6939.

This book will contain information and directions pertaining to the Time Capsule, a metal cylinder containing a record of life today. This Capsule is to be buried at the New York World's Fair grounds with the expectation that scientists 5000 years hence may recover it and learn from its contents the story of our civilization.

Inside the Capsule will be all sorts of data describing life in 1939. Most of this will be reproduced in microfilm, a method which makes possible the concentration of much information in small space. How we live, what we wear, where we work, what we know of religion, history, geography, and science will all be included.

The Capsule itself has been fabricated by craftsmen at the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company out of a new and exceptionally durable metal—cupaloy—a copper alloy. It measures seven and a half feet in length and it is about eight inches in diameter. On September 23, it will be delivered to the World's Fair grounds to be buried 50 feet underneath the Westinghouse building. There it will await the passing of the centuries.

A vital part of this whole project is the "time resistant" Book of Record. Even assuming that archeologists in 6939 will have become exceedingly wise, they can hardly be expected to unearth the Time Capsule without some instructions. So the ultimate discovery of the Capsule depends on the permanence of this book.

It will tell the history of the Capsule and describe in detail where it is located. Maps and geodetic surveys have been included in the book which are so accurate that future scientists should be able to fix the exact spot of burial within one inch.

By distributing copies of the "time book" to every important library and museum in the world, it is hoped that some of these volumes will survive the centuries and guide men of 6939 to the capsule record.

The books are being produced with two thoughts in mind. First, they must resist the ravages of time. Secondly, they must exemplify the finest printing possible in 1939.

Frederic W. Goudy has designed the type to be used in the book, and he is engraving an unusual initial letter for the first page. The type is being set by the Village Press, Marlboro, N. Y. The book will be printed on paper made by the Hurlbut Paper Company from the highest rag base. Free from deteriorating agents, it is as permanent a stock as can be manufactured today.

Special formulations for super-permanent red and black ink have been prepared by the Research Laboratories of the International Printing Ink Corporation. In case you're interested in inks to last 5000 years, here are the formulas. (It takes nearly 5000 years to say them.) Red—diazotised 5-chloro-orthotoludine with beta hydroxynaphthoic-5-chloro-orthotoluidide. Black—carbon black with Syan Blue B (copper phthalocyanine) as a toner.

Just in case the English language is no longer familiar to the world of 6939, a phonetic "key" to English worked out by the Smithsonian Institution is to be included in the book. Thus those who discover it will be able to decipher the language symbols so common to us today. A "mouth map" which shows how we make the sounds of various letters will clarify further "English as she is spoke."

No book produced 5000 years ago—when Moses was still in the bullrushes—exists today. And whether the Book of Record will survive the ravages of half a hundred centuries is, of course, a question. But one thing is certain. None of us alive today will be around long enough to check up on it.

Millar Golf Tournament Held at Elmsford

The twelfth annual Millar Golf Tournament was held at the Knollwood Country Club at Elmsford, N. Y. on September 13th and 14th after a sumptuous luncheon at the Clubhouse on September 13th. All hands repaired to the golf links, and after playing the usual 18 holes an extra hole, or the 19th, was well enjoyed by everyone.

In the evening the boys played bridge and poker. The two members of the Knollwood Club, George Johnson and Henry Savage were the hosts for the evening and being one of the hosts Henry Savage gave the poker party. A gentlemen named S. L. from New England had a field day both at the card table and on the links. He annexed everything in sight except the shirts and trousers of his fellow players. Details from Henry Savage on request.

The golf prizes were won by the following: Walter Sisson—Racquette River Paper Company; Henry Savage—International Paper Company; Fred Burkhardt—Holyoke, Mass.; S. L. Willson—Holyoke, Mass.

Among those attending were: Rufus Sisson, Potsdam, N. Y.; Walter Sisson, Potsdam, N. Y.; George Johnson, Champion Fibre Company; J. L. Riegel, Riegel Paper Corporation; I. L. Gartland, D. M. Bare Paper Company; Henry Savage, International Paper Company; S. L. Willson, Holyoke, Mass.; J. F. Levens; J. J. Dillon; Bud Seiler and L. C. Greenman, Geo. W. Millar & Co., Inc.

This function has become very popular among the paper manufacturers and is eagerly looked forward to, and if Judge John Dillon would only snore a little more softly and let the fellows sleep it would add to the enjoyment of the occasion and would help some of the fellows play a better game the next day. Ask Bill Raymond who slept in the hall. He knows. They also claim that the Judge's snoring helps his game and gives him an undue advantage over the other contestants.

POWER PROJECT DEFERRED

(Continued from page 7)

of rag content bond paper, started combining rags and sulphite 50 years ago. Eastern firms ridiculed the idea but the Gilbert company found a ready market when it was able to market its product at a lower price.

The Gilbert company also was the first to install an air-drier and to use new rags only in production of certain papers. Not until this year did the last competing paper mill install an air-drier machine. The first laboratory to guide production of paper also was established by the Gilbert company, the speaker declared.

CONSTRUCTION NEWS

A Summary of Vital Facts Regarding Construction, Financing and Operation of Pulp and Paper Mills

General Construction News

Middletown, Ohio—The Interstate Folding Box Company, Liberty avenue, manufacturer of folding and other paper boxes and containers, has approved plans for new plant unit, to be one and two-story, totaling about 28,000 square feet of floor space. It is estimated to cost close to $80,000, with equipment. Company will establish offices in the new building. General contract for erection has been awarded to M. F. Quill & Son, 512 East 13th street, Cincinnati, Ohio, and superstructure will be placed under way at early date. Samuel Bergstein is president.

Menominee, Mich.—The Hoskin Paper Company, manufacturer of kraft and other paper stocks, has awarded general contract to John Salen & Son, Menominee, for new filter plant building at mill, to be one and two-story, 55 x 95 feet, recently referred to in these columns. Work is scheduled to begin at once. An award for steel sash has been made to Crittall-Federal, Inc., Waukesha, Wis. The Norwood Engineering Company, Florence, Mass., has contract for the filter equipment. New unit is estimated to cost about $40,000. L. A. DeGuere, Wisconsin Rapids, Wis., is consulting engineer.

Newark, N. J.—The Mono Service Company, 349 Oraton street, manufacturer of paper containers for food products, has removed its plant to a new five-story addition to building at location noted, situated on Verona avenue, and will carry out increased operations in new unit. The vacated portion of structure, known as the Mono Service Building, has been leased by Edward F. Caldwell & Company, Inc., New York, N. Y., and will be occupied for another line of production.

Akron, Ohio—The Buckeye Envelope Company, recently organized with capital of 250 shares of stock, no par value, plans operation of local paper-converting plant for the manufacture of envelopes and other commercial paper specialties. New company is represented by Vernon Weygandt, Flatiron Building, Akron, one of the incorporators. Fred O. Johnson, Akron, is also interested in the company.

Lufkin, Tex.—The Southland Paper Mills, Inc., is arranging final details of new local pulp and paper mill for newsprint production, previously referred to in these columns, and expects to have superstructure of main units in progress at early date. The mill has been laid out in four main operating units, comprising several large buildings, equipped for an initial capacity of 50,000 tons per annum. Plant is estimated to cost close to $7,500,000, with equipment and is scheduled to be ready for production before the close of 1939. General erection contract was let recently to Chapman-Merritt & Scott Corporation, 17 Battery place, New York, N. Y. George F. Hardy, 305 Broadway, New York, is consulting engineer. Ernest L. Kurth is president of the company, and also is head of the Angelina Lumber Company, Lufkin.

Cincinnati, Ohio—The Strobridge Lithographing Company, 108 West Central Parkway, manufacturer of paper specialties, has completed plans for extensions and improvements in plant, including a five-story building unit and alterations in existing structure. Work is reported to cost in excess of $45,000, with equipment. General contract has been awarded to the M. Marcus Building Company, 2109 Reading road, and work is scheduled to proceed at once. Tietig & Lee, 34 West Sixth street, Cincinnati, are architects.

Philadelphia, Pa.—Fire recently damaged a portion of plant of the Walter P. Miller Company, Inc., 452 York avenue, manufacturer of paper boxes and containers, resulting from the destruction of an adjoining factory by fire, occupied by the Victor-Springfield Tire Company. An official estimate of loss has not been announced, but is reported as slight.

Woonsocket, R. I.—The American Paper Tube Company, Woonsocket, manufacturer of hardened and impregnated paper tubing and kindred products, has concluded negotiations for the purchase of the local plant and business of the Shambow Shuttle Company, and will operate as a subsidiary interest in the future. Harold L. Armhein, treasurer and general manager of purchasing company, will be president of the Shambow company in the future, and Edmond H. Guerin, Jr., assistant treasurer of the paper tube company, will be secretary and treasurer.

New York, N. Y.—The Continental Gummed Products Company, Inc., recently organized with capital of 600 shares of stock, plans early operation of a local paper-converting plant for the production of gummed paper products and kindred specialties. New company is represented by Abraham Israelite, 292 Madison avenue, New York, attorney.

Binghamton, N. Y.—The Agfa-Ansco Corporation, Charles street, manufacturer of photographic and other processed paper stocks, films and photo-

graphic products, has awarded general contract to the W. E. Wark Company, 1608 Walnut street, Philadelphia, Pa., for proposed new multi-story addition to plant, recently referred to in these columns, and superstructure will be placed under way soon. New unit will cost close to $150,000, with equipment. Lockwood, Greene Engineers, Inc., 30 Rockefeller Plaza, New York, N. Y., is architect and engineer.

Buffalo, N. Y.—E. I. du Pont de Nemours & Co., Inc., du Pont Building, Wilmington, Del., Rayon Division, is advancing production in cellulose rayon mill on River road, Tonawanda, Buffalo, and is placing the plant on a 100 per cent capacity schedule, as compared with 80 per cent operations a few weeks ago. Working hours have been increased to a full 40-hour week, as against a 32-hour weekly basis, as heretofore. In adjoining mill given over to cellophane manufacture, an improved operating schedule is under way, with the mill now running at less than capacity. A number of employes in the latter plant are on a 36-hour weekly basis.

Savannah, Ga.—In connection with recent purchase of the mill of the Oakfield Gypsum Products Corporation, Oakfield, N. Y., by the National Gypsum Company, 190 Delaware avenue, Buffalo, N. Y., the latter company has begun to dismantle three steel frame buildings on site and will remove to new plant site at Savannah, where the units will be re-erected as part of the new wallboard mill of the company at that place. A number of other structures, also, will be built. As previously noted in these columns, the Savannah mill is estimated to cost about $1,000,000, with machinery and equipment. The George A. Fuller Company, 597 Madison avenue, New York, N. Y., is engineer and contractor for the plant.

Melbourne, Australia—The Australian Paper Manufacturers, Ltd., Melbourne, Victoria, has arranged for the permanent closing of its strawboard mill at Broadford, and will transfer production of this kind to another mill of the company. The Broadford mill is over 50 years old and the raw materials as used for production are no longer obtainable in that area for the plant. In order to maintain activity, such products would have to be shipped to the mill by rail, effecting a prohibitive manufacturing cost.

Milan, Italy—The S. A. Tessile Artificali, Milan, is arranging to take over the Pizzighettone cellulose rayon mill in Cremona Province, owned by the S. A. Italo-Olandese Enka, and will operate as a new mill unit for same line of production. Plant has a rated capacity of about 4500 tons per annum and will be developed for this output at early date.

New Companies

Troy, N. Y.—The American Fibre Corporation has been incorporated with capital of 200 shares of stock, no par value, to manufacture fiber products, cellulose rayon specialties, etc. New company is represented by Jacob S. Seidman, 80 Broad street, New York, N. Y., attorney.

Chicago, Ill.—Standard Papers, Inc., 100 West Monroe street, has been chartered with capital of 100 shares of stock, no par value, to manufacture and deal in envelopes and other commercial paper products. Incorporators include S. Jurek, W. E. Fisher and Joseph J. Sullivan, Jr., address noted. Last mentioned is company representative.

New York, N. Y.—The Longacre Paper and Printing Company has been organized with capital of 100 shares of stock, no par value, to deal in paper products of various kinds. New company is represented by Continental Lawyers Albany Service, 305 Broadway, New York.

Sturgeon Mill Nears Completion

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., September 19, 1938—A newly organized company has under way the construction of a new twelve ton ground wood pulp mill at Sturgeon Falls, Ont. H. B. Gibbs, manager of the organization, says that the building will be finished in a few days. He added that the mill would ultimately have four grinders but only two would be installed immediately. The new Sturgeon River Pulp Company is said to be backed by Toronto capital and has replaced the syndicate which unsuccessfully negotiated with the Ontario government and the receiver of the Abitibi Power & Paper Company, Limited, for use of the long idle Abitibi plant at Sturgeon Falls. The new mill is located across the river from the Abitibi property.

Injured at Paper Machine

[FROM OUR REGULAR CORRESPONDENT]

CARTHAGE, N. Y., September 19, 1938—Dorrence Moses, third hand machine operator at the National Paper Products Company, received a badly cut scalp, bruises and burns in an accident at the mill early this week. He received treatment from a local physician before being removed to the hospital in West Carthage. He was smoothing paper on a machine winder when an 800-pound rider roller dropped on his left arm, pulling his arm partly into the machine. He was thrown against the machine framework and a number of stitches were required to close a wound on his head. His body was burned by friction when he was thrown against the rapidly moving paper roll. His condition is not regarded as serious and his friends look for an early recovery.

Government Paper Bids

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., September 21, 1938—The Government Printing Office has received the following bids for 5,000 sheets of 24 x 36 brown cloth lined cover paper: Virginia Paper Company, $131.00 per M sheets; R. P. Andrews Paper Company, $129.70; Mathers-Lamm Paper Company, $126.65 less 2 per cent; Barton, Duer & Koch Paper Company, $125.59; Walker, Goulard, Plehn Company, $126.67 less 2 per cent; Andrews Paper House of York, $123.50; Whitaker Paper Company, $124.96; Nashua Gummed and Coated Paper Company, $126.67 less 2 per cent; and Mudge Paper Company, $125.12.

A. M. Eaton Paper Co. Burned

[FROM OUR REGULAR CORRESPONDENT]

WALTHAM, Mass., September 19, 1938—Fire in a building occupied by the A. M. Eaton Paper Company, 140 Lexington street, in the heart of the business district, caused a loss estimated at $15,000 last Friday.

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REDISTRIBUTION OF INCOME

The National Economic Committee has planned to begin its preliminary inquiry of the economic and social state of the country the middle of next month. The incentive for this comprehensive survey comes from the conclusions and recommendations embodied in various earlier reports on the low incomes of some fifty million workers. It is an attempt to put into a more concrete form the theory of the redistribution of wealth or, as now less vaguely phrased, a more equitable redistribution of income.

The theory underlying the activity of the National Economic Committee is to find a solution for the low per capita income of so many of our citizens and, when it is determined how income is distributed, to attempt through Federal control to strike a better balance. The apparent objective is, of course, a controlled economy or the regimentation of the sources of wealth to our national income of which industry is the largest contributor.

The basic factor in the New Deal is a more equitable distribution of income through political control of all important national resources, which socialistic concept is not new and antedates by centuries the doctrine of Karl Marx who persuasively advocates the production of goods for use without profit. Four years ago President Roosevelt established an overall planning agency known as the National Resources Committee. This planning bureau of the Administration includes Secretary Ickes as chairman, the Secretaries of War, Commerce, Agriculture, Labor, and Relief. The vice-chairman and chairman of the Advisory Committee is Frederic A. Delano, an uncle to President Roosevelt. The President in creating the committee stated it was to prepare for him "a program and plan of procedure dealing with the physical, social, governmental, and economic aspects of public policies for the development and use of land, water and other national resources."

In a study by the National Resources Committee made two years ago and now available in a report, the distribution of about fifty-nine billion dollars of income among American people in the year beginning July 1, 1935, is discussed. The report estimates that one-third of all families and individual consumers had incomes of less than $780; one-half received less than $1,070; and two-thirds received less than $1,450. This means, the report points out, that some 13,000,000 breadwinners had to support families of two or more, or themselves alone, on $15 a week or less. And that 26,000,000 breadwinners had to support themselves and families, on a weekly wage of $27 or less. Eighty-nine per cent of all consumer units had incomes of less than $2,500 a year. Less than one per cent received $10,000 a year or more. Some of the more important facts revealed by the report are: heads of families receive on the average $1,622 a year: single individuals receive on the average $1,151 a year. The poorest third of the population had an average income in 1935-36 of $471, and the total amount received by this low-income group was approximately the amount of money received by the richest one-half of one per cent of the population. The average farm family receives $1,259 a year, which is $545 less than the average city family receives. The income of families on relief were not included. The average wage-earning family, not on relief, receives $1,289 a year, compared with $4,200 for families of salaried business men.

The trend of Government in attempting to extend economic aid to the millions in the low income group may be discerned in a recent broadcast address of Daniel C. Roper, Secretary of Commerce. Mr. Roper said in part: "Without endangering a reasonable return on the real invested capital, improvements in techniques need to be passed on to the consumer in the form of lower costs and an equitable share to labor rather than to reach the stockholder and management in the form of excessive dividends and salaries. A failure of distribution to meet adequately human needs is a serious obstacle to prosperity and to world peace and happiness. We have accomplished wonders in production, but far too little in economic distribution. When we solve, and we will solve, the problem of balanced distribution of goods and services, we shall have removed the pivotal log in the jam that retards the attainment of that degree of social and economic progress which our resources and our genius justify.

"The distribution system, as well as the system of production must be purged of uneconomic and wasteful practices and functions at less cost. The modern-

ization of policies will seek a more uniform but less spectacular rate of profit for those engaged in production and distribution, to the end that people generally may enjoy more of the fruits of sustained mass-production efficiency. Since mass production falls short of its objectives without the support of mass consumption, prices must be better aligned with demands and purchasing power. The proper balancing requires constant adjustment so that shifting needs and demands may be promptly met through proper changes in production and distribution. Public opinion in America can be counted on to condemn any minority, whether in the household of capital, of labor, or any other unit that would attempt through unfair practices to secure unjust gains."

Effect of War on Newsprint Market

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., September 19, 1938—The newsprint situation, which has gradually been growing more encouraging, is now the subject of much comment and speculation owing to the war clouds in Europe. Just what an outbreak across the water would have upon affairs has not been determined but producers believe there would be a tendency for prices to ascend and the mills to increase their output which was thirty per cent below normal last month, with mill stocks now slightly larger than a year ago at this particular period.

Commenting on the present state of things, one leading manufacturer said, "There is no doubt that with a war being waged the circulation of all newspapers would instantly be increased. This would look like augmented demand from the mills. There are several other factors, however, to be considered from the standpoint of the publisher who will be faced with added costs in the way of news despatches, services and more frequent issues. All this and the likelihood of a sharp rise in the value of newsprint with thousands of new readers, may be offset or neutralized by a reduction in the size of the papers and in the number of pages. Present stocks would last only a few months but, with a sharp decrease in reading pages (which can be accomplished by the elimination of several features not directly concerned with the war), the public would not censure the owners, several of whom now complain that metropolitan dailies are altogether too large and people have not time to read one tithe of what they contain. Thus, while circulation during the war might ascend, so far as newsprint consumption is concerned, this would be balanced by a reduction in size and the law of average would prevail."

No concerted action has been taken as yet by the Canadian publishers but if the outlook does not get brighter, there is no doubt but that the owners will meet and plan action in the interest of economy, service and continuity of production.

Delaware Valley Section Officers Meet

The officers of the Delaware Valley Section of the Technical Association of the Pulp and Paper Industry met at the St. David Country Club on Friday September 16, to discuss the future programs of the section.

Production Ratio Report

These statistics are based upon paper production reports to the American Paper and Pulp Association.

COMPARATIVE MONTHLY SUMMARIES

Months	1938(c)	1937(c)	1936	1935	1934
January	63.9%	90.3%	76.1%	65.8%	.....
February	68.7%	90.1%	77.9%	70.0%	.....
March	69.6%	90.3%	76.0%	70.5%	.....
April	68.3%	92.1%	82.3%	70.0%	.....
May	69.0%	90.6%	81.6%	69.4%	.....
June	65.8%	87.3%	80.7%	72.3%	.....
July	71.9%	81.8%	77.3%	64.9%	.....
August	77.2%	82.9%	81.5%	70.9%	.....
September	.....	78.6%	80.5%	71.9%	58.2%
October	.....	73.5%	87.6%	75.6%	64.7%
November	.....	61.9%	88.0%	75.3%	61.7%
December	.....	54.5%	85.9%	71.2%	59.6%
Year Average	.....	80.6%	81.3%	70.5%	.....
First 36 weeks	69.3%	87.4%	79.0%	69.0%	.....

COMPARATIVE WEEKLY SUMMARIES

CURRENT WEEKS, 1938		CORRESPONDING WEEKS, 1937	
*August 6	73.1%	August 7	82.6%
*August 13	77.1%	August 14	82.1%
*August 20	78.1%	August 21	83.7%
*August 27	80.0%	August 28	83.3%
*September 3	77.5%	September 4	80.7%
*September 10	64.7%	September 11	68.7%

The following statistics show the number of mills reporting by ratio groups:

	Number of Mills Reporting, Current Weeks					
Ratio Limits	Aug. 6, 1938	Aug. 13, 1938	Aug. 20, 1938	Aug. 27, 1938	Sept. 3, 1938	Sept. 10, 1938
0% to 50%	89	81	84	77	77	65
51% to 100%	217	225	219	224	214	133
Total Mills Reporting	306	306	303	301	291	198

* Subject to revision until all reports are received.
(c) Basic capacity data have been adjusted to correspond with ratings reported by individual companies.

PAPERBOARD OPERATING RATIOS

According to reports from the National Paperboard Association, per cents of operation, based on "Inch-Hours," were as follows:

Mos.	1938 (e)	1937 (e)	1936	1935	Mos.	1938 (e)	1937 (e)	1936	1935
Jan.	55%	80%	61%	61%	July	57%	67%	69%	59%
Feb.	61%	86%	67%	67%	Aug.	66%	74%	75%	65%
Mar.	60%	87%	68%	67%	Sept.	....	70%	76%	69%
Apr.	57%	89%	70%	61%	Oct.	....	66%	82%	76%
May	58%	86%	68%	61%	Nov.	....	56%	79%	70%
June	56%	75%	68%	65%	Dec.	....	46%	74%	60%

Week end. Aug. 6, 1938—64%
Week end. Aug. 13, 1938—65%
Week end. Aug. 20, 1938—67%
Week end. Aug. 27, 1938—69%
Week end. Sept. 3, 1938—67%
Week end. Sept. 10, 1938—57%

(e) Basic figures revised to include new members of the National Paperboard Assn.

Japanese Paper Production Declines

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., August 31, 1938—Production of paper by members of the Japan Paper Manufacturers' Association during May reached 80,842 short tons, a decline of about 2 per cent compared with April and almost 14 per cent compared with May 1937. Output during the first 5 months of the current year amounted to 391,755 tons, which was 10 per cent below the corresponding total in 1937. Imports of paper during May totaled 1,404 tons, slightly more than double the amount imported during the preceding month but 73 per cent below arrivals during May 1937. Imports during the first 5 months of 1938 totaled 6,355 tons and were 74 per cent below arrivals during the corresponding period in 1937. Exports during May totaled 12,983 tons, 4 per cent less than during April, and 3 per cent below shipments during May 1937.

Sales of paper continued to be larger than output as a result of industry's drive to move stocks and also because of the shortage of pulp.

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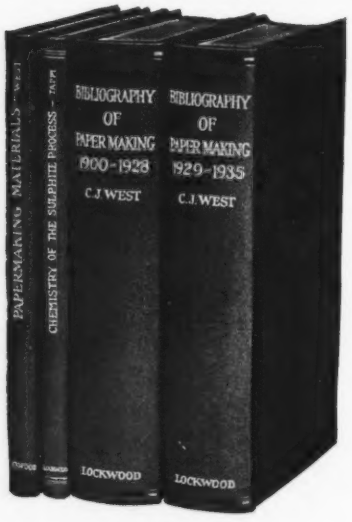

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FOR PAPER MEN

Section of the
Technical Association of the Pulp and Paper Industry

Edited by Ronald G. Macdonald, Secretary

Review Of The Paper Industry Literature

Abstracts Compiled By the Abstracts and Bibliography Committee of the Technical Association of the Pulp and Paper Industry, A. Papineau-Couture, John F. Ohlson, C. E. Peterson and Clarence J. West, Chairman.

Copies of United States Patents can be obtained from the United States Patent Office, Washington, D. C., for 10 cents each. Send currency, not stamps.

Alkaline Processes

Pulping Process. U. Pomilio. Belg. pat. 423,106 (Sept. 30, 1937).—Vegetable materials are treated with alkali and chlorine under such conditions that the temperature reached during the reaction is not sufficiently high to cause any deterioration of the fibers. The alkali treatment is carried out in a closed vessel and under pressure; the chlorine treatment is carried out in an open vessel and at atmospheric pressure.—A.P.-C.

Chlorination of Milk of Lime at the Syas'sk Paper Mill. D. M. Shilinskii. Bumazhnaya Prom. 15, no. 6: 15-21 (1937); C. A. 32:2349.—In the slaking of quicklime (60 per cent CaO) the hydration and settling time decreased and the temperature increasing with the increasing concentration of calcium oxide (6-12 per cent). In the laboratory experiments the results were improved by adding 50 per cent of the required water and the balance in several portions. In the factory the best results were obtained by continuous addition of calcium oxide and at a maximum concentration. By this method the amount of large grained particles was considerably reduced and the uniformity of the chlorination of the solution was made practical. The Syas'sk bleaching liquor contains 80-97 per cent of calcium hypochlorite (active chlorine), 2-4 per cent calcium chloride and 2-13 per cent calcium chlorite of the total combined chlorine. The concentration of calcium hypochlorite increases with the lower rate of chlorination and the greater calcium oxide concentration, and that calcium chlorate increases with the higher rate of chlorination independent of the calcium oxide concentration. The absolute content of calcium chloride is independent of the calcium oxide concentration and the rate of chlorine passage. In all the chlorinations at 40° and the final alkalinity of 5-8 grams per liter of calcium oxide, the calcium chloride concentration was equal at about 1-1.2 grams per liter. The relative content of calcium chloride increases with lower concentrations of calcium oxide.—C.J.W.

Continuous Causticizing. Torolf Lassenius. Finnish Paper and Timber J. 20, no. 2: 64, 66, 68, 70, 72; no. 3: 94-96, 98, 100, 102 (Jan. 1, Feb. 15, 1938); Svensk Pappers-Tidn. 41, no. 2: 39-41 (Jan. 31, 1938); B. I. P. C. 8:276.—The author discusses at first the influence of such factors as liquor concentration, sulphidity, temperature of reaction, insoluble alkali, quality of lime, effect of concentration, causticity, stirring period, and rapidity of stirring upon the rate of sedimentation, as well as the effect of liquor concentration on the lime consumption for different causticities. He then describes in detail the Dorr continuous causticizing system at Kaukopää, and mentions briefly three older systems, Infilco, Tesch, and Mount-Glamorgan. In conclusion, operating data from Kaukopää are given, showing that savings in alkali, power, and labor are possible with this method. Twenty literature references, chiefly to American sources, are included.—C.J.W.

How to Control the Continuous Recausticizing System. C. L. Knowles. Paper Trade J. 106, no. 9:33-38 (March 3, 1938.)—The author suggests practical ways and means for the operator of a continuous recausticizing plant to control the entire system and maintain it at maximum efficiency. The suggestions are based on practical experience at over a dozen kraft mills with an aggregate producing capacity of 3500 tons of pulp per day.—A.P.-C.

Conductometric Analytical Control in the Direct Causticizing of Soda Black Liquor. T. R. McElhinney, E. R. Whittemore and D. F. J. Lynch. Paper Trade J. 106, no. 10:37-41 (March 10, 1938).—A modified conductometric titration method and the necessary inexpensive conductometric apparatus are described which offer a rapid, convenient and reasonably accurate analysis of soda black liquor.—A.P.-C.

Control of the Chemical Pulping of Straw. I. Z. Obozyi. Bumazhnaya Prom. 15, no. 1:58-62 (April, 1937); Chimie & Industrie 39, 136.—The quantity of lignin per 1. of liquor may be determined by calculation from the differences in the specific gravity of the liquor (before neutralization with hydrochloric acid) and of the filtrate (after neutralization and precipitation of the lignin). The amount of lignin thus found is calculated to the basis of the original straw, and the result obtained is the "percentage cooking of the pulp."—A.P.-C.

Chemistry of The Alkaline Wood Pulp Processes*

V. Effect of Chemical Ratio at Constant Initial Concentration and the Effect of Initial Concentration on the Rate of Delignification and Hydrolysis of Douglas Fir by the Sulphate Process

By Sidney L. Schwartz [1] and Mark W. Bray [2]

Abstract

Two small-scale sulphate pulping studies on Douglas fir sawdust have recently been made at the Forest Products Laboratory. (1) The effect of changing the chemical-wood ratio at constant initial concentration of cooking liquor, and (2) the effect of changing the initial concentration of the cooking liquor for several specific chemical-wood ratios were the principal factors studied. The data obtained show that rate of delignification is accelerated by increasing the ratio of chemical to wood; the rate of decomposition of the cellulose is also increased, and the purity of the residues is not materially enhanced by going beyond a 30 per cent ratio. The effect of increasing the initial concentration is shown to vary with the specific chemical-wood ratio. At 15 per cent chemical the yield and purity of the pulp are but little influenced by concentration, at 30 per cent its effect is appreciable, and at 60 per cent it is pronounced.

The ratio of chemical to wood, though an important industrial consideration, is shown to be a pseudo variable. Beyond the kraft range, 15 to 25 per cent chemical, the significance of increasing concentration is shown to be pronounced. Increasing the ratio of chemical to wood is shown to maintain the mean concentration throughout the digestion.

The yield data are evaluated mathematically. The mathematical representation of the data consists of the derivation of several empirical equations from which under given stated conditions the yield of pulp may be predetermined, the limitations of these equations are considered and tables are given to show such limitations.

The heterogeneous nature of the pulping reaction is discussed.

Introduction

Pursuant to a better understanding of the role played by the several variables of the alkaline pulping reaction, this article presents additional data obtained at the Forest Products Laboratory on two of the more important variables of the sulphate process, namely, concentration and ratio of chemical to wood.

Since the reaction variables of alkaline pulping influence not only the rate of pulping and the efficiency of wood delignification, but also the character of the pulps produced, it goes without saying that a definite knowledge of them would assist materially in clarifying our concepts of this method of pulping. From a practical standpoint these variables may be classified as either independent or dependent. Independent variables are those, such as time and temperature of digestion, which may be changed without affecting any of the others. The dependent variables, on the other hand, are those which cannot be changed without affecting one or more of the others, such as ratio of chemical to wood charged, concentration of chemicals, and volume of liquor in contact with the wood. Thus it is impossible to change the ratio of chemical to wood at constant initial concentration unless the volume of cooking liquor is changed or the amount of wood added to a given volume varied. Likewise, it is impossible to change the concentration without changing, simultaneously, either the volume or the chemical-wood ratio. Hence the variables studied and reported herein are interlocking; the results expressed in terms of one must be qualified in terms of the other.

Approximately 10 years ago Arrhenius (*1*), in his analysis of J. Brunn's data, asserted that the pulping of wood by the alkaline process obeys the law of a monomolecular reaction. Schmidt-Nielsen (*11*), working on the physical-chemistry of the soda process, refuted Arrhenius' contentions shortly thereafter. The desire to place alkaline pulping practices on sound physical and chemical principles prompted later investigators to delve into the kinetics of alkaline pulping, but owing to the heterogeneous nature of wood and the complexity of the reactions involved, it is not surprising that this was not accomplished. To be sure, valuable data were collected, but the issue, as to whether the laws governing heterogeneous or homogeneous reactions applied, was far from being clarified. Those who considered the delignification reaction as homogeneous were faced with the problem of determining whether it was of a first, second, or third order.

It appears that since the reaction is heterogeneous

TABLE I.—CHEMICAL ANALYSES OF DOUGLAS FIR (SHIPMENT 1344)

Characteristic determined	Sept. 17, 1931 Per cent	Mar. 19, 1933 Per cent
Lignin	29.8	29.8
Total cellulose	61.7	62.1
Alpha cellulose	46.1	47.0
Alpha cellulose (based on weight of cellulose)	74.7	75.6
Pentosan-free cellulose	54.5	...
Total pentosans	8.7	...
Pentosan weight in cellulose	4.5	...
Total chlorine consumed in the isolation of cellulose	37.9	...

* Presented at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, Green Bay, Wis., September 8-10, 1938.

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Preceding articles in this series are: I. Aspen, loblolly and jack pines by the soda process. Wells, Grabow, Staidl, and Bray. Paper Trade J. *76*, No. 24, 49 (Apr. 13, 1923); II. Effect of temperature on the rate of delignification and hydrolysis of spruce wood with sodium hydroxide. M. W. Bray. Paper Trade J. *87*, No. 23, 64 (Dec. 6, 1928); III. Pulping of white pine by the soda and soda-sulphur processes. Bray, Martin, and Carpenter. Paper Trade J. *93*, No. 12, 33 (Sept. 17, 1931); IV. Is there a critical pulping temperature for the sulphate process? Martin, Bray, and Curran. Paper Trade J. *97*, No. 20, 38, (Nov. 16, 1933).

TABLE II.—PULPING OF DOUGLAS FIR BY THE SULPHATE PROCESS. EFFECT ON YIELD AND PULP PROPERTIES OF INCREASING THE RATIO OF CHEMICAL TO WOOD AT CONSTANT INITIAL CONCENTRATION OF CHEMICAL

Series No.	Digestion No.	Ratio of total chemical to wood, per cent	Time of digestion, hrs.	Cooking and yield data: Cooking liquor: Concentration: Total volume, cc.	NaOH, gms. per liter	Na2S, gms. per liter	Total gms. per liter	Weight of O.D. wood charged, grams	Analysis of spent liquor (Calculated as NaOH): Free alkali content, grams per liter	Free alkali consumed, per cent	Free alkali consumed, gms. per cu. on wood basis, per ct.	Yield: Weight of O.D. residue or pulp, grams	Yield of pulp, per cent	1/t log A/A—X	Results based on oven-dry weight of fibrous residue: Cellulose: Lignin, per cent	Cellulose: Total, per cent	Cellulose: Alpha, per cent	Pentosans: Total, per cent	Pentosans: In cellulose, per cent	Chlorine consumption, per cent	Results based on oven-dry weight of wood charged: Cellulose: Lignin, per cent	Cellulose: Total, per cent	Cellulose: Alpha, per cent	Pentosans: Total, per cent	Pentosans: In cellulose, per cent	Chlorine consumption, per cent	Lignin removed, per cent	Cellulose removed, per cent	Alpha cellulose removed, per cent
I	318	15	1	62.5	45	15	60	25,055	2.5	95.2	12.6	15,108	60.30	0.2198	19.3	79.4	66.1	6.7	6.4	23.5	11.6	47.9	39.9	4.0	3.1	...	...	...	...
	317	15	2	62.5	45	15	60	25,003	1.3	97.6	12.9	14,740	58.95	.1145	19.5	80.4	66.8	6.1	6.5	31.2	11.5	47.4	39.4	3.6	3.1	...	...	...	...
	308	15	4	62.5	45	15	60	25,062	1.3	97.6	12.9	14,355	57.27	.0605	20.2	80.3	66.0	6.4	6.8	29.7	11.6	46.0	37.8	3.7	3.1	...	...	...	...
	314	15	8	62.5	45	15	60	25,033	.6	98.9	13.0	13,882	55.45	.0320	18.9	80.5	66.8	5.9	6.2	24.7	10.5	44.7	37.0	3.3	2.8	...	...	...	...
II	309	20	1	83.3	45	15	60	25,064	6.3	88.0	15.4	13,728	54.78	.2614	13.9	84.3	67.9	6.5	6.2	19.3	7.6	46.2	37.2	3.6	2.9	...	...	...	...
	310	20	2	83.3	45	15	60	25,003	5.4	89.7	15.8	13,702	54.80	.2612	13.9	85.1	72.0	6.6	6.4	19.8	7.6	46.6	39.5	3.6	3.0	...	...	...	...
	311	20	4	83.3	45	15	60	25,045	3.7	93.0	16.3	12,643	50.48	.1485	9.9	89.8	75.6	6.3	6.5	16.4	5.0	45.4	38.2	3.2	2.9	...	...	...	...
	312	20	8	83.3	45	15	60	25,046	2.8	94.7	16.6	11,887	47.46	.0809	7.3	91.8	77.4	6.7	6.4	11.3	3.5	43.6	36.7	3.2	2.8	...	...	...	...
III	313	20	8	83.3	45	15	60	25,137	1.7	96.8	17.0	11,457	45.58	.0427	6.6	91.6	67.3	6.4	5.9	11.5	3.0	41.7	30.7	2.9	2.5	...	...	...	...
	316	25	1	104.2	45	15	60	25,047	11.7	77.8	17.1	12,783	51.04	.2921	9.1	90.8	77.9	5.9	6.0	11.2	4.6	46.3	39.7	3.0	2.8	...	...	...	...
	320	25	2	104.2	45	15	60	25,030	10.8	79.5	17.4	11,593	46.31	.1671	4.2	96.5	81.4	6.5	6.3	7.5	1.9	44.7	37.7	3.0	2.8	...	...	...	...
	315	25	4	104.2	45	15	60	25,024	7.3	86.2	19.0	10,684	42.69	.0925	1.8	97.9	83.3	5.8	5.9	5.7	.8	41.8	35.6	2.5	2.5	...	...	...	...
	317	25	8	104.2	45	15	60	25,069	5.3	90.0	19.8	10,055	40.11	.0496	.5	98.2	86.2	6.2	5.4	4.9	.2	39.4	34.6	2.5	2.1	...	...	...	...
IV	302	30	1	125.0	45	15	60	25,059	18.5	64.9	17.1	12,468	49.75	.3031	7.9	92.0	84.1	5.7	5.4	9.2	3.9	45.8	41.9	2.8	2.5	...	...	...	...
	303	30	2	125.0	45	15	60	25,066	15.7	70.2	18.5	11,273	44.97	.1735	3.2	97.4	89.3	5.3	5.6	5.2	1.4	43.8	40.2	2.4	2.4	...	...	...	...
	304	30	4	125.0	45	15	60	25,011	12.9	75.5	19.9	10,305	41.20	.0963	1.0	98.0	82.0	5.0	5.4	3.8	.4	40.4	33.8	2.1	2.2	...	...	...	...
	319	30	8	125.0	45	15	60	25,029	11.5	78.2	20.6	10,315	41.21	.0963	.8	99.0	84.2	5.1	5.0	5.0	.3	40.8	34.7	2.1	2.0	...	...	...	...
	306	30	8	125.0	45	15	60	25,042	8.6	83.7	22.0	9,327	37.26	.0536	.2	99.1	82.3	4.8	4.6	2.9	.1	36.9	30.7	1.8	1.7	...	...	...	...
V	325	40	1	166.5	45	15	60	25,054	26.5	49.7	17.5	12,331	49.22	.3079	5.8	94.2	81.3	4.6	4.4	11.5	2.9	46.3	40.0	2.3	2.0	...	...	...	...
	324	40	2	166.5	45	15	60	25,016	22.6	57.1	20.0	10,885	43.51	.1807	2.2	97.6	84.0	5.1	4.8	8.1	1.0	42.5	36.6	2.2	2.0	...	...	...	...
	322	40	4	166.5	45	15	60	25,034	20.6	60.9	21.4	9,949	39.74	.1002	.7	97.6	84.2	4.5	4.5	3.9	.3	38.8	33.5	1.8	1.7	...	...	...	...
	329	40	8	166.5	45	15	60	25,008	17.1	67.6	23.7	8,481	33.91	.0587	.4	98.8	79.4	3.7	3.6	3.3	.1	33.5	26.9	1.3	1.2	...	...	...	...
VI	331	60	1	250.0	45	15	60	25,053	34.7	34.2	18.0	11,643	46.47	.3328	5.2	94.2	86.4	4.0	3.8	7.7	2.4	43.8	40.2	1.9	1.7	...	...	...	...
	328	60	2	250.0	45	15	60	25,040	32.7	38.0	20.0	10,568	42.21	.1873	.8	97.5	84.9	3.9	3.8	5.2	.3	41.1	35.8	1.6	1.6	...	...	...	...
	327	60	4	250.0	45	15	60	25,020	31.1	41.0	21.6	9,560	38.21	.1045	.5	98.6	84.8	3.8	3.6	3.3	.2	37.7	32.4	1.5	1.3	...	...	...	...
	330	60	8	250.0	45	15	60	25,036	27.5	47.8	25.2	8,226	32.86	.0604	.5	99.2	79.0	3.5	3.1	3.3	.2	32.6	26.0	1.2	1.0	...	...	...	...
	332	80	4	266.7	45	15	60	20,000	35.0	33.6	23.6	7,423	37.12	....	.4	100.0	89.6	...	3.3	3.4	.1	37.1	33.3	...	1.2	37.9	...	...	...
																				Analysis of original wood		29.8	61.7	46.1	8.7	6.8			

[1] Maximum temperature 170 deg. C. for all cooks.

on the face of things, it should be handled as such. What had appeared as mathematical analyses of data were, in reality, mathematical representations of the analytical data secured. Accordingly, they added little to the knowledge of the physical-chemical relationships in alkaline pulping.

C. R. Mitchell and F. H. Yorston *(7)*, who undertook the determination of (1) the function of sodium sulphite in kraft pulping, and (2) the cause of incomplete delignification, worked on the rate of delignification as a means only toward an end. Nolan and McCready *(9)* in a recent study of constant concentration pulping similar to that of Mitchell and Yorston *(7)*, testify to the empiricism in the mathematical representation of alkaline pulping data.

From the work herein reported, it is safe to postulate that clearer understanding of the pulping reactions and of pulping kinetics will be had only when the concentration of the chemical in the cooking liquor is maintained constant throughout the entire digestion period and sufficient quantity of liquor is added to insure adequate penetration and complete delignification. By so treating the system, the number of variables may be considered reduced by two—volume, and ratio of chemical to wood—and the problem thus simplified.

No attempt has been made to parallel the work of the Canadian Forest Products Laboratory *(10)* in high concentration soda pulping with high concentration sulphate pulping. In pulping with highly concentrated liquors it was found that the experimental steel equipment was strongly attacked by the liquor and finely divided deposits of a dark green material, probably a mixture of ferrous hydroxide and ferrous sulphide, appeared in the pulp. Hence, studies at these extremely high concentrations were not made.

Materials

Preparation and Analysis of the Wood

The wood for these experiments was prepared from sound 4-foot bolts of Douglas fir in the form of sawdust. In its preparation, the wood was chipped, screened, mixed, air dried, then oven-dried, and finally reduced to sawdust in a No. 1 Wiley grinding mill. The sawdust thus prepared was passed through standard sieves and that portion which passed through a 40- and was retained on a 60-mesh

sieve was collected for the pulping experiments. This material showed, upon chemical analysis, the characteristics reported in Table I.

PREPARATION AND ANALYSIS OF THE COOKING LIQUOR

The cooking liquor consisted of a mixture of sodium hydroxide and sodium sulphide with the two chemicals in the ratio of 3:1, respectively. Concentrated sodium hydroxide and sodium sulphide liquors, and water were mixed to approximately the ratio just mentioned. A 5-cc sample was titrated with 0.125 normal sulphuric acid, using first phenolphthalein and then methyl orange indicators. The difference between the two titrations subtracted from the phenolphthalein titration gives the sodium hydroxide content in terms of cc of 0.125 normal sulphuric acid. For the estimation of the sulphide content, another 5-cc sample was added to 25 cc of iodine, I_2, solution, (acidified with glacial acetic acid) of known normality and back titrated with 0.1 normal sodium thiosulphate solution. Proper adjustments were made and the liquor reanalyzed before charging the pulping unit.

In order to avoid the customary changes in the cooking liquors, the liquors used were prepared just previous to cooking.

Apparatus and Experimental Procedure

The digestions were made in a 350-cc steel autoclave *(2)* heated by means of a thermostatically controlled oil bath. Preheating the autoclave in an auxiliary oil-bath permitted better control of the constant temperature bath. For these experiments the following procedure was employed:

A 25-gram sample of the Douglas fir sawdust, previously dried for 16 hours at 105 deg. C., was put into the autoclave with the required amount of cooking liquor. The autoclave thus charged was placed in a preheating bath and subsequently in a thermostatically controlled bath both of which had been brought to the desired temperatures. In order to approach a uniform rate of increase in temperature, the preheating bath was maintained from 15 to 25 deg. C. above the scheduled maximum cooking temperature (170 deg. C.) depending upon the quantity of material charged in the autoclave. Even though this precaution was taken the time required to bring the contents of the autoclave to the maximum digestion temperature varied, requiring from 18 to 24 minutes in the first set of experiments and approximately 25 minutes in the second.

Upon completion of the predetermined cooking period, the pulp was separated from the spent liquors by filtration on a Buchner funnel. The fibrous residues were washed with hot water, with dilute acetic acid (10 per cent solution), and finally with 2 to 3 liters of hot water. For the determination of pulp yield, the fibrous residue was first air-dried and then oven-dried to constant weight at 105 deg. C. The spent liquor was analyzed for its free alkali content.

In addition to the determination of the yield of fibrous residue, the pulps were subjected to chemical analysis. The methods adopted at the Forest Products Laboratory were applied *(3)*.

DESCRIPTION OF TESTS

I. Six series of pulping tests, consisting of four digestions each, were made at 170 deg. C. to determine the effect on rate of pulping of changing the ratio of chemical to wood from 15 to 60 per cent. In addition one 4-hour digestion at 80 per cent of chemical was made. In all experiments the total initial concentration was 60 grams per liter. In order to follow the reaction as it progressed, time of digestion alone was varied for each particular ratio of chemical to wood chosen.

The major conditions employed for the digestions and the results of the pulping experiments are reported in Table II.

II. The study of the effect of changing the initial concentration of chemical in the cooking liquor on the rate of pulping was carried on in such manner as to divide the problem into three typical cases; in the first, the quantity of chemical was insufficient to promote complete delignification; in the second, the quantity of chemical was sufficient; while in the third, the quantity of chemical was in considerable excess of that necessary to complete the pulping reaction. The concentrations employed for the several chemical-wood ratios were limited by the size and nature of the autoclave and by the necessity of using a volume of liquor capable of completely moistening the sawdust charged into the autoclave. In all series the concentrations were varied in increments of 20 grams per liter.

The cooking conditions, other than those just mentioned, were similar to those in the previous series. The temperature-increase period approximated 25 minutes in all cases.

The major condition of the digestions and the results of the pulping experiments are given in Table III.

Discussion of Results

A certain amount of chemical is necessary for complete delignification; and, as chemical is consumed (the volume of liquor remaining approximately constant) the concentration of the chemical in the cooking liquor automatically changes. In addition, the change in concentration depends on the initial ratio of chemical to wood as well as on the percentage of chemical consumed. Therefore, the greater the percentage of chemical added, the nearer an approach is made to pulping with a liquor, the concentration of which is maintained at a definite concentration (60 grams per liter in this case) throughout the digestion. In other words, the mean concentration is maintained at a higher figure as the ratio of chemical to wood charged is increased.

The pulping of sawdust with sulphate liquor, under the conditions designated in these experiments, was exceedingly rapid during the first hour of digestion. In fact for some of the series the major portion of the pulping was practically completed in the first hour of digestion. The chemical consumption follows the trend of the pulping reaction.

I.—THE EFFECT OF CHANGING THE RATIO OF CHEMICAL TO WOOD ON THE PULPING OF WOOD AT CONSTANT INITIAL CONCENTRATION

Increasing the ratio of chemical to wood increased the velocity of the removal of both lignin and cellulose (Fig. 1); however, from a purely pulping standpoint, increasing it beyond 30 per cent of the weight of wood charged did not produce any material gain so far as purity of pulp was concerned. In other words, purer pulps (higher cellulose and lower lignin content) were not obtained by cooking with more than 30 per cent of chemical. As determined

TABLE III.—PULPING DOUGLAS FIR BY THE SULPHATE PROCESS. EFFECT ON YIELD AND PULP QUALITY OF CONCENTRATION OF CHEMICALS IN COOKING LIQUOR FOR SEVERAL SPECIFIC RATIOS OF CHEMICAL TO WOOD CHARGED

	Cooking and yield data												Chemical properties of the pulps									
	Cooking liquor							Analysis of spent liquor (Calculated as NaOH)			Yield		Results based on oven-dry weight of fibrous residue						Results based on oven-dry weight of wood charged				
	Concentration													Cellulose		Pentosans				Cellulose		Pentosans	
Digestion No.	NaOH, gms. per liter	Na_2S, grams per liter	Total, grams per liter	Volume of liquor, cc.	Ratio of total chemical to wood, per cent	Total time of digestion, hours	Weight of O.D. wood charged, grams	Free alkali content, grams per liter	Free alkali consumed, per cent	Free alkali consumed on wood basis, per ct.	Weight of O.D. residue or pulp, grams	Yield of pulp, per cent	Lignin, per cent	Total, per cent	Alpha, per cent	Total, per cent	In cellulose, per cent	Chlorine consumption, per cent	Lignin, per cent	Total, per cent	Alpha, per cent	Total, per cent	In cellulose, per cent
SERIES I																						
352	15	5	20	187.5	15	2	25.002	1.4	92.0	12.1	15.576	62.30	22.0	76.3	65.1	7.3	6.7	25.3	13.7	47.5	40.6	4.5	3.2
347	15	5	20	187.5	15	4	25.013	.4	97.7	12.9	14.480	57.88	18.8	80.4	68.4	7.0	6.6	24.2	10.9	46.6	39.6	4.1	3.1
350	30	10	40	93.8	15	2	25.018	1.0	97.1	12.8	14.701	58.76	18.2	79.1	67.9	6.7	6.3	21.5	10.7	46.5	39.9	3.9	2.9
348	30	10	40	93.8	15	4	25.011	1.0	97.1	12.8	14.071	56.26	16.4	82.7	69.4	7.1	6.1	21.9	9.2	46.6	39.1	4.0	3.4
307	45	15	60	62.5	15	2	25.003	1.3	97.6	12.9	14.740	58.95	19.5	80.4	66.8	6.1	6.5	31.2	11.5	47.4	39.4	3.6	3.1
308	45	15	60	62.5	15	4	25.062	1.3	97.6	12.9	14.355	57.27	20.2	80.3	66.0	6.4	6.8	29.7	11.6	46.0	37.8	3.7	3.1
SERIES II																						
353	15	5	20	270.0	30	2	18.016	8.9	49.3	13.0	10.265	56.97	16.8	81.4	69.5	6.6	6.3	21.1	9.6	46.4	39.6	3.8	2.9
354	15	5	20	270.0	30	4	18.003	7.6	56.9	15.0	9.595	53.29	13.5	85.0	73.4	6.5	6.4	19.6	7.2	45.3	39.1	3.5	2.9
341	30	10	40	187.5	30	2	25.012	11.0	68.7	18.1	11.768	47.05	4.6	94.7	82.3	6.5	6.8	9.5	2.2	44.6	38.8	3.1	3.2
342	30	10	40	187.5	30	4	25.016	9.8	72.1	19.0	10.879	43.49	1.3	99.1	84.2	5.9	6.0	6.6	.6	43.1	36.6	2.6	2.6
303	45	15	60	125.0	30	2	25.066	15.7	70.2	18.5	11.273	44.97	3.2	97.4	89.3	5.3	5.6	5.2	1.4	43.8	40.2	2.4	2.5
304	45	15	60	125.0	30	4	25.011	12.9	75.5	19.9	10.305	41.20	1.0	98.0	82.0	5.0	5.4	3.8	.4	40.4	33.8	2.1	2.2
351	60	20	80	93.8	30	2	25.017	21.0	70.1	18.5	10.935	43.65	2.1	97.3	83.5	5.0	5.0	7.3	.9	42.5	36.5	2.4	2.1
349	60	20	80	93.8	30	4	25.013	14.6	79.3	20.9	10.122	40.45	1.1	98.6	82.8	4.9	5.1	6.0	.4	39.9	33.5	2.0	2.1
338	75	25	100	75.0	30	2	25.028	...	...	...	10.779	43.07	1.9	98.3	80.2	5.3	4.8	7.9	.8	42.3	34.6	2.3	2.1
375	75	25	100	75.0	30	2	25.020	20.8	76.4	20.1	10.785	43.11	2.0	97.8	81.2	5.0	4.6	8.2	.9	41.2	35.0	2.1	1.9
380	75	25	100	75.0	30	4	25.002	17.0	80.7	21.3	9.761	39.04	.9	98.5	81.1	4.7	4.8	6.2	.4	38.4	31.6	1.8	1.8
335	90	30	120	62.5	30	2	25.027	...	...	...	10.516	42.02	1.2	97.5	78.2	5.7	5.1	6.9	.5	41.0	32.9	2.4	2.1
333	90	30	120	62.5	30	4	25.007	...	...	...	9.358	37.42	1.3	99.0	70.2	4.9	4.9	6.5	.5	37.0	26.3	1.8	1.8
SERIES III																						
355	30	10	40	270.0	60	2	18.003	24.4	30.6	16.1	8.250	45.82	3.1	95.6	83.3	5.4	5.5	7.9	1.4	43.8	38.1	2.5	2.4
356	30	10	40	270.0	60	4	18.000	23.3	33.7	17.8	7.583	42.19	1.2	97.7	85.2	4.8	5.3	6.3	.5	41.2	36.0	2.0	2.2
328	45	15	60	250.0	60	2	25.040	32.7	38.0	20.0	10.568	42.21	.8	97.5	84.9	3.9	3.8	5.2	.3	41.2	35.8	1.6	1.6
327	45	15	60	250.0	60	4	25.020	31.1	41.0	21.6	9.560	38.21	.5	98.6	84.8	3.8	3.6	3.3	.2	37.7	32.4	1.5	1.4
343	60	20	80	187.5	60	2	25.031	41.7	40.7	21.4	10.179	40.67	.5	99.2	83.7	3.0	2.9	6.3	.2	40.4	34.1	1.2	1.2
344	60	20	80	187.5	60	4	25.004	37.5	46.7	24.6	8.892	35.56	.3	99.8	80.0	2.6	2.2	4.9	.1	35.5	28.5	.9	.8
340	75	25	100	150.0	60	2	25.020	...	...	...	9.565	38.23	.4	98.6	84.0	2.7	2.5	5.2	.2	37.7	32.1	1.0	1.0
377	75	25	100	150.0	60	2	24.998	50.5	42.5	22.4	9.597	38.39	.3	99.1	85.4	2.7	2.1	4.8	.1	38.1	32.8	1.0	.8
378	75	25	100	150.0	60	4	25.006	45.4	48.3	25.5	8.374	33.49	.1	99.6	79.0	2.0	1.8	4.8	.0	33.4	26.5	.7	.6
386	75	25	100	150.0	60	4	24.999	44.1	50.2	26.4	8.409	33.63	...	...	...	...	...	...	...	...	...	...	...
379	90	30	120	125.0	60	2	25.015	56.3	46.6	24.6	9.293	37.15	.5	99.1	80.9	2.7	2.3	6.0	.2	36.8	30.1	1.0	.8
384	90	30	120	125.0	60	2	25.007	55.9	47.0	24.8	9.307	37.22	...	...	...	...	...	...	...	...	...	...	...
383	90	30	120	125.0	60	4	25.008	47.3	55.1	29.1	7.752	31.00	.2	99.9	71.2	2.2	2.1	4.9	.1	31.0	22.1	.7	.7
385	90	30	120	125.0	60	4	24.990	47.9	54.5	28.7	7.739	30.97	...	...	...	...	...	...	...	...	...	...	...
346[2]	150	50	200	75.0	60	2	25.017	...	...	...	7.160	28.61	.4	99.2	55.6	2.9	2.6	4.0	.1	28.4	15.9	.8	.7
345	150	50	200	75.0	60	4	25.025	...	...	...	5.065	20.24	.3	99.7	48.2	...	1.9	3.6	.1	20.2	9.8	...	.4

[1] Maximum temperature 170 deg. C. for all digestions.
[2] Autoclave attacked by cooking liquor. Pulp residues were covered with ferrous sulphide and hydroxide which were removed by washing with dilute hydrochloric acid.

by the usual methods of analysis, some lignin resisted even the extremely severe pulping treatments, for example, the 8-hour period of digestion with 60 per cent chemical resulted mainly in low yields rather than in pulps of high purity. In such cases an excessive loss of cellulose, without any apparent gain in ease of bleaching, is noticed.

Nevertheless, within certain ranges, the time necessary to produce a pulp of a given degree of purity was approximately halved by doubling the ratio of chemical to wood. This is best illustrated by comparing pulps of approximately equal yields representing both easy bleaching and semibleachable type (Table IV).

Data in Table V show the effect resulting from a too drastic treatment.

II.—The Effect of Increasing the Initial Concentration of Chemicals in the Cooking Liquor on the Pulping of Wood for Several Specific Ratios of Chemical to Wood

As expected, it was found that the greater the concentration of chemical in the cooking liquor the more rapid the rate of dissolution of the wood. However, this effect of concentration was not so apparent in the series where only 15 per cent of chemical was added, possibly because of the rapid disappearance of practically all free alkali in the very early stages of digestion for all cooks of this series. Apparently, the early stages of pulping consist mainly of a neutralization of the acidic substances produced by the hydrolysis of certain substances in the wood. The decrease in concentration of free alkali in this series is so rapid that its effect as a pulping agent is practically terminated early in the digestion. In a previous study *(4)* it was found that in cooking with as much as 20 per cent of chemical, using a 3:1 ratio of sodium hydroxide to sodium sulphide, respectively, that varying the concentration of chemical in the cooking liquor from 70 to 100 grams per liter had but little effect on the yields of the resulting pulps.

However, in the series where the digestions were made with 30 per cent total chemicals, greater changes in yields resulted for a given time of pulping as the concentration was varied. The yields of pulp

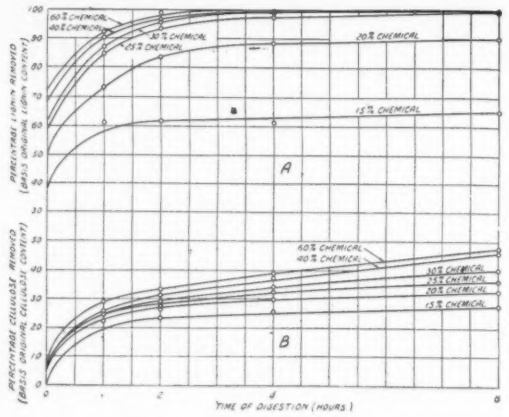

FIG. 1.

The Effect of Increasing the Ratio of Chemical To Wood on the Velocity of the Removal of Both Lignin and Cellulose from Douglas Fir by Sulphate Process (A)—Relation Between Lignin Removal and Time of Digestion (B)—Relation Between Cellulose Removal and Time of Digestion.

residues of cooks 342, 304, 349, 380, 335, and 333, though somewhat similar in chemical characteristics, show an increase in the dissolution reaction as a result of an increase in the initial concentration of cooking liquor. Table VI shows in an abbreviated form the cooking conditions and chemical characteristics.

The similarity of the various pulps in some chemical characteristics is due to the fact that they had all been cooked to a point where further cooking tends to hydrolyze cellulose rather than effect further delignification. The yield of pulp from digestion 342 is greater than that of any of the others shown in Table VI and the latter pulps are shown to have suffered losses in alpha cellulose greater than the difference in yields would indicate.

In the series where the chemical to wood ratio was 60 per cent the effect of concentration was similar to that of the 30 per cent series, but to a much greater degree. For a given time of pulping the higher concentrations produced decidedly lower pulp

TABLE IV.—COMPARISON OF THE CHEMICAL PROPERTIES OF BOTH EASY- AND SEMI-BLEACHABLE PULPS OF APPROXIMATELY EQUAL YIELDS.

Digestion No.	Digestion Type	Ratio of chemical to wood, Per cent	Total time of digestion, Hours	Yield, Per cent	Lignin, Per cent	Cellulose, Per cent	Alpha cellulose, Per cent	Total pentosans, Per cent	Pentosans cellulose, Per cent	Chlorine consumption, Per cent
315	Semi-bleachable	25	4	42.69	1.8	97.9	83.3	5.8	5.9	5.7
324		40	2	43.51	2.2	97.6	84.0	5.1	4.8	8.1
304, 319	Easy-bleaching *	30	4	41.20	0.9	98.5	83.1	5.1	5.2	4.4
328		60	2	42.21	0.8	97.5	84.9	3.9	3.8	5.2
320	Semi-bleachable	25	2	46.31	4.2	96.5	81.4	6.5	6.3	7.5
303		30	2	44.97	3.2	97.4	89.3	5.3	5.6	5.2
331		60	1	46.47	5.2	94.2	86.4	4.0	3.8	7.7
306	Easy-bleaching	30	8	37.26	0.2	99.1	82.3	4.8	4.6	2.9
322		40	4	39.74	0.7	97.6	84.2	4.5	4.5	3.9
327		60	4	38.21	0.5	98.6	84.8	3.8	3.6	3.3

* Average of two cooks.

TABLE V.—COMPARISON OF NORMAL AND DRASTIC COOKING ON YIELDS AND CHEMICAL PROPERTIES OF PULPS.

Digestion No.	Digestion Type	Ratio of chemical to wood, Per cent	Total time of digestion, Hours	Yield, Per cent	Lignin, Per cent	Cellulose, Per cent	Alpha cellulose, Per cent	Total pentosans, Per cent	Pentosans cellulose, Per cent	Chlorine consumption, Per cent
317	Normal	25	8	40.11	0.5	98.2	86.2	6.2	5.4	4.9
304, 319	Normal *	30	4	41.20	0.9	98.5	83.1	5.1	5.2	4.4
306	Strong	30	8	37.26	0.2	99.1	82.3	4.8	4.6	2.9
329	Drastic	40	8	33.91	0.4	98.8	79.4	3.7	3.6	3.3
330		60	8	32.86	0.5	99.2	79.0	3.5	3.1	3.3

* Average of two cooks.

TABLE VI.—A COMPARISON OF PULPS OF THE 30 PER CENT SERIES OF QUITE SIMILAR CHEMICAL CHARACTERISTICS

Digestion No.	Concentration, Grams per liter	Total time of digestion, Hours	Yield, Per cent	Chemical characteristics: Lignin, Per cent	Cellulose, Per cent	Alpha cellulose, Per cent
342	40	4	43.49	1.3	99.1	84.2
304	60	4	41.20	1.0	98.0	82.0
349	80	4	40.45	1.1	98.6	82.8
380	100	4	39.04	0.9	98.5	81.1
335	120	2	42.02	1.2	97.5	78.2
333	120	4	37.42	1.3	99.0	70.2

yields. However, the point of interest is that in cooking with a liquor the initial concentration of which is 40 grams per liter, the factor of chemical-wood ratio is not so decided as in cooking with a liquor having an initial concentration of 120 grams per liter. This fact is best illustrated through observing the differences in yield of the comparable pulps of the two series as shown in Table VII.

TABLE VII.—THE DIFFERENCES IN YIELDS OF COMPARABLE PULPS OF THE 30 PER CENT AND 60 PER CENT SERIES

Total concentration of chemical in the cooking liquor, Grams per liter	Total time of digestion, Hours	Yield: 30 per cent series, Per cent	Yield: 60 per cent series, Per cent	Difference in yield, Per cent
40	2	47.05	45.82	1.23
40	4	43.49	42.19	1.30
60	2	44.97	42.21	2.76
60	4	41.20	38.21	2.99
80	2	43.65	40.67	2.98
80	4	40.45	35.56	4.89
100	2	43.07	38.23	4.84
100	4	39.04	33.49	5.55
120	2	42.02	37.15	4.87
120	4	37.42	31.00	6.42

The data shown are further evidence that ratio of chemical to wood is a pseudo factor in pulping kinetics, and is merely a means of maintaining concentration at a point sufficient to carry on the delignification reaction.

In light of the foregoing it appears that the mean concentration of chemical in the cooking liquor throughout the digestion may be the controlling factor. Of course this statement must be qualified because other factors affect the rate of pulping and the quality of the pulp. Experimentation on constant concentration, or, perhaps, countercurrent cooking is necessary to clarify our concepts of alkaline pulping. It is indeed surprising that in spite of the fact that soda pulp had been made commercially by the Ungerer countercurrent process *(12)* some twenty years ago but little data is available on this method of pulping. Haslam and Ryan *(5)* in their investigations of countercurrent digestion of wood about fourteen years ago indicated that they had but scratched the surface of this particular phase of pulping. However, from the data in Table II some deductions relating to this line of thought may be derived. For example, if the concentration of free alkali in the spent liquors is plotted against time of digestion, a method of estimating the mean concentration of chemicals in the cooking liquors for the corresponding digestions is obtained. By determining the areas under these curves at their limits, for the 1-, 2-, 4-, and 8-hour cooking periods and dividing by the corresponding periods of digestion, the mean concentrations of the cooking liquor throughout that period of digestion may be obtained. The scale of measurement on both the ordinate and the abscissa must be equal or allowances made for variations of that nature. The data thus secured are given in Table VIII.

TABLE VIII.—THE MEAN CONCENTRATION OF CHEMICAL IN THE COOKING LIQUOR OF DIGESTIONS LISTED IN TABLE II.

Digestion No.	Ratio of chemical to wood, Per cent	Total time of digestion, Hours	Initial free alkali concentration, Grams per liter	Mean free alkali concentration, Grams per liter
318	15	1	52.7	28
307	15	2	52.7	15
308	15	4	52.7	8
314	15	8	52.7	4
309	20	1	52.7	30
311	20	2	52.7	17
312	20	4	52.7	10
313	20	8	52.7	6
316	25	1	52.7	32
320	25	2	52.7	22
315	25	4	52.7	16
317	25	8	52.7	11
302	30	1	52.7	36
303	30	2	52.7	27
304	30	4	52.7	21
306	30	8	52.7	16
325	40	1	52.7	40
324	40	2	52.7	32
322	40	4	52.7	27
329	40	8	52.7	23
331	60	1	52.7	44
328	60	2	52.7	39
327	60	4	52.7	35
330	60	8	52.7	32

It is of interest to note that the tenacious lignin and coloring matter is removed at relatively low concentrations. For example, a comparison of the data on digestions 341 and 342 in Table III discloses decided differences in the yield, lignin content, and in chlorine consumption values of the two pulps. These were brought about by increasing the digestion period from 2 to 4 hours where the concentration of free alkali in the liquor was approximately 10.5 grams per liter (range 11 to 9.8).

Should the Pulping Reaction (Reactions) be Considered as a Homogeneous or as a Heterogeneous Type?

If the yield data obtained in the study of the effect of ratio of chemical to wood (Table II) are represented in the form of an empirical mathematical equation as disclosed and explained under the succeeding heading "Mathematical Representation of Yield Data," a means of estimating the yield of pulp is obtained. The equation is applicable when cooking with sulphate liquor having an initial concentration of 60.0 grams per liter and containing sodium hydroxide and sodium sulphite in a ratio of 3:1, respectively.

In Table IX, comparison of observed and calculated yields is made by means of this equation. Having found it to be satisfactory, it is then possible to determine the relative speeds of pulping at various ratios of chemical to wood. The time (calculated) necessary to pulp to given yields is shown in Table

TABLE IX.—A COMPARISON OF OBSERVED AND CALCULATED YIELD VALUES

Ratio of chemical to wood, Per cent	Total time of digestion, Hours	Calculated yields, per cent,	Observed yields, per cent
15	1	59.6	60.30
15	2	57.7	58.95
15	4	55.7	57.27
15	8	53.8	55.45
20	1	54.2	54.80
20	2	51.3	50.48
20	4	48.4	47.46
20	8	45.4	45.58
25	1	51.4	51.04
25	2	47.9	46.31
25	4	44.3	42.69
25	8	40.5	40.11
30	1	49.8	49.75
30	2	45.8	44.97
30	4	41.8	41.20
30	8	37.6	37.26
40	1	47.8	49.22
40	2	43.3	43.51
40	4	38.7	39.74
40	8	34.1	33.91
60	1	45.9	46.47
60	2	41.0	42.21
60	4	36.0	38.21
60	8	31.0	32.86

X for the various chemical to wood ratios. As may be noted the percentage increase in the speed of the pulping reaction is one of diminishing proportions. It is evident that the effect of increasing the ratio of chemical to wood at constant initial concentration is a means of approach towards maintaining the initial concentration at a constant value.

TABLE X.—DATA SHOWING THAT THE EFFECT OF INCREASING THE RATIO OF CHEMICAL TO WOOD AT CONSANT INITIAL CONCENTRATION ON REACTION SPEED IS ONE OF DIMINISHING PROPORTIONS

Ratio of chemical to wood Per cent	30 per cent yield	40 per cent yield	50 per cent yield	60 per cent yield
	Calculated time (t) of digestion necessary to produce the above yield			
	Hours	Hours	Hours	Hours
20	243.0	26.40	2.75	.24
25	56.4	8.75	1.32	.17
30	25.1	5.26	.96	.15
40	14.8	3.22	.70	.13
60	9.2	2.29	.56	.13
80	7.4	1.96	.51	.12
100	6.6	1.81	.49	.12
00 [1]	4.5	1.37	.41	.11
15	8960.0	832.00	30.80	0.86

[1] As R approaches infinity the values of k and a approach the following limits: $k = 0.370$; $a = -1/1.30 + 1 = 0.230$.

Consider a typical homogeneous reaction of the second order, such as the reaction of ethyl alcohol and acetic acid to form ethyl actetate and water. Let the reaction shown by equation (a) represent a closed system in which the interaction of 1 mole of acid and 1 mole of alcohol has reached a state of equilibrium.

(a) $(C_2H_5OH + CH_3COOH \leftrightarrows H_2O + CH_3COOC_2H_5)$

(b) $$\frac{(\text{Conc. } C_2H_5OH)\ (\text{Conc. } CH_3COOH)}{(\text{Conc. } H_2O)\ (\text{Conc. } CH_3COOC_2H_5)} = K$$

Then, as exemplified by (b), each constituent is definitely related. Upon the addition to the system of any one of the constituents, in the manner equivalent to increasing the ratio of chemical to wood at constant initial concentration, an entirely new system is established. The concentration of each constituent is changed. This is not comparable to the pulping of wood; the concentration of wood, if it may be so designated, does not change upon increasing the ratio of chemical to wood.

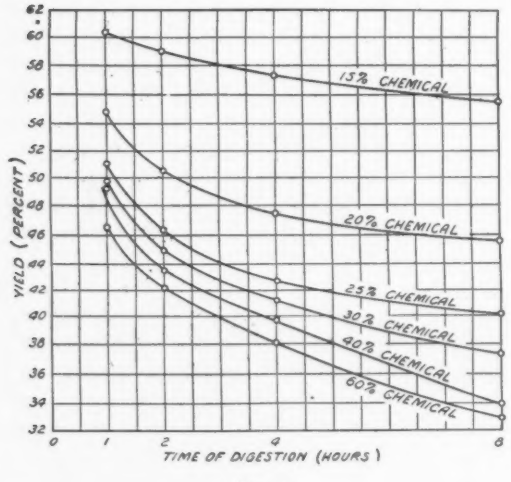

FIG. 2.

Relation of Time of Digestion to Yield for Several Ratios of Chemical to Wood (Pulping of Douglas Fir By Sulphate Process).

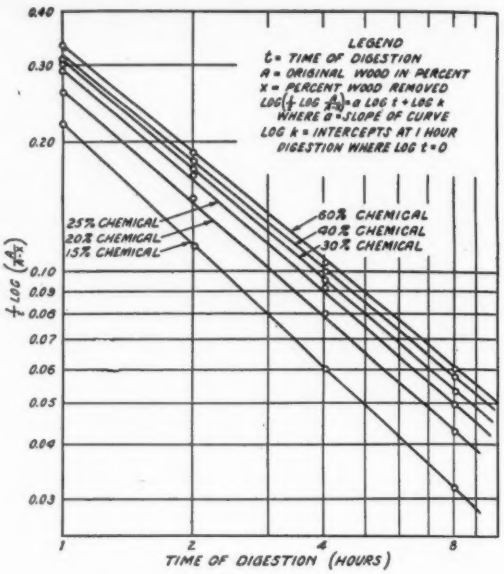

FIG. 3.

Rectification of Yield—Time Curves of Figure 2 (Pulping of Douglas Fir by Sulphate Process)

The pulping of wood is quite similar to other well known heterogeneous reactions. In a liquid-solid type reaction it has been found that the reaction takes place at the interface, the boundary, and that the speed of the reaction is often governed by the rate of diffusion of the reagent into the film at the interface. The law of diffusion may apply only when the speed of the reaction is greater than that of the speed of diffusion. The speed of the reaction when governed by the speed of diffusion is given by the following equation *(8)*:

$$\frac{dx}{dt} = kS\ (a\text{-}x) = \frac{D}{\delta} S\ (a\text{-}x)$$

where

S = contact surface
$(a\text{-}x)$ = concentration of the reagent at any instant
k = a constant, the magnitude of which depends on the diffusion coefficient, D, and the thickness of the interfacial layer, δ.

Assuming a system where S is constant, and that sufficient mixing of the bulk of the reagent is taking place, then increasing the volume of the reagent is a means of maintaining the concentration. Therein lies the similarity between the pulping of wood and typical heterogeneous reactions.

Evidence *(6)* has been offered to support contentions that the alkaline pulping reaction could be considered as homogeneous and of the second order. However, the analogy established between the sulphate pulping of wood and a typical heterogeneous reaction is much more acceptable. In regard to heterogeneous reactions, Nernst *(8)* pointed out the following: "***** in chemical reactions which occur merely at the boundary between two phases, the phenomenon is essentially one of diffusion, it is useless to try and determine the order of reaction from the rate at which they proceed as has often been attempted; this method or argument is applicable, only according to the kinetic considerations, to the probability of collisions in homogeneous systems and loses its meaning when applied to heterogeneous systems.

"It has already been pointed out that velocities of diffusion only determine rate of reaction when no other process (formation of thin surface layers, as when marble is dissolved in sulphuric acid and so on) interfere, and especially when no slow process, taking place in the homogeneous phase, is connected with the progress of the reaction. Thus arsenic trioxide dissolves in water much slower than would be expected from the velocity of diffusion; this is because simple solution is accompanied by a slow process of hydration, and it is obviously the latter process that determines the rate of solution."

Mathematical Representation of Yield Data

Not being able to express the rate of reaction mathematically in terms of fundamental chemical concepts, empirical equations were derived. Thus the effect of one variable when qualified in terms of others could be expressed in numerical terms. This was accomplished in the following manner:

I Pulp yields for different ratios of chemical to wood charged were plotted against time of digestion and a series of curves were obtained as shown in Fig. 2. These curves were rectified by plotting the expression (i/t log A/A—X) against t, time of digestion, on logarithmic coordinates where A is the original amount of wood in percent and X is percentage of wood removed. From the rectified curves shown in Fig. 3, the following equation, which has already been discussed, is obtained: $Y = 100\ (10-kt^{(a+1)})$ where Y denotes the yield of pulp in per cent.

$\log k$ = intercept at 1 hour digestion, where $\log t = 0$
a = slope of curve

the numerical values of a and k in terms of ratio of chemical to wood, R, are

$$a = \frac{-R}{1.30\ R - 3.20}$$

$$k = \frac{-2.38}{1.30\ R - 3.20} + 0.370$$

the derivation of which are indicated in Figs. 4 and 5, respectively.

II In a manner similar to that just presented, empirical equations were derived which gave yield *(Y)* in terms of *(t)* time of digestion, and *(C)* initial concentration qualified for the specific chemical-wood ratios. As the experimental work was limited to 2- and 4-hour digestions for each concentration studied, it was necessary to assume that in all cases the

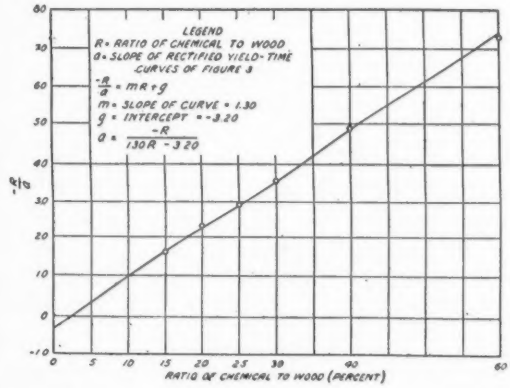
LEGEND
R = RATIO OF CHEMICAL TO WOOD
a = SLOPE OF RECTIFIED YIELD-TIME CURVES OF FIGURE 3
-a/a = mR + g
m = SLOPE OF CURVE = 1.30
g = INTERCEPT = -3.20
a = -R / 1.30R - 3.20
a/a
RATIO OF CHEMICAL TO WOOD (PERCENT)

Fig. 4.

Relation of the Ratio of Chemical to Wood to (a) the slopes of the Rectified Yield-Time Curves of Figure 3 (Pulping of Douglas Fir by Sulphate Process)

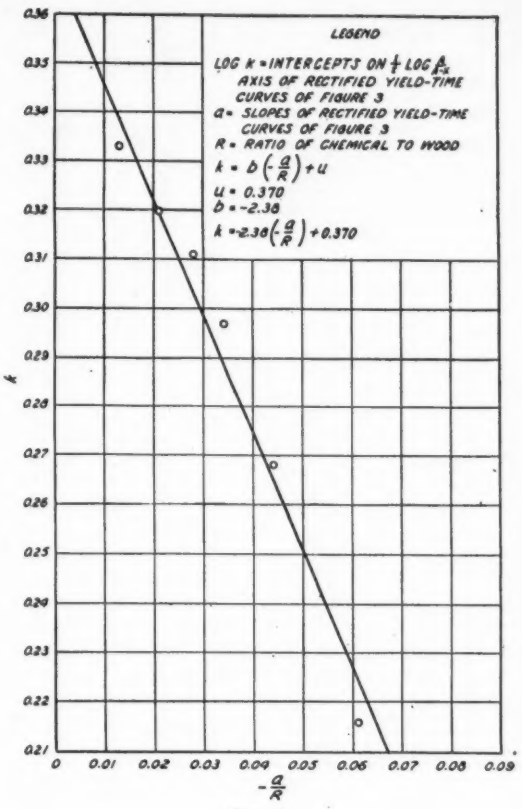
LEGEND
LOG k = INTERCEPTS ON 1/t LOG A/A-X AXIS OF RECTIFIED YIELD-TIME CURVES OF FIGURE 3
a = SLOPES OF RECTIFIED YIELD-TIME CURVES OF FIGURE 3
R = RATIO OF CHEMICAL TO WOOD
k = b(-a/R) + u
u = 0.370
b = -2.38
k = -2.38(-a/R) + 0.370
k
-a/R

Fig. 5.

Relation of the Ratio of Chemical of Wood to (k) (Pulping of Douglas Fir by the Sulphate Process)

(1/t log A/A—X) relationship plotted against t on logarithmic coordinates always gave a straight line relationship.

The general formula for all three cases is

$$Y = 100\ (10^{-kt^{(t+1)}_{C}})$$

$$\text{where } h = \frac{-C}{\alpha C + \beta}$$

$$\text{and } f = \frac{-C}{\xi C + \Delta}$$

The values of α, β, ζ and Δ as determined for the specific ratios of chemical to wood *(R)* are as follows:

R in per cent	α	β	ξ	Δ
15	4.27	20	1.08	2
30	2.65	38	1.20	0
60	2.33	38	1.30	—5

A comparison of observed and calculated yields of this study as shown in Table XI indicate that the empirical equations obtained are, with a few exceptions, satisfactory. However, if yield is to be expressed in terms of ratio of chemical to wood *(R)*, initial concentration of the cooking liquor *(C)*, and time of digestion *(t)*, the task becomes that of expressing α, β, ζ and Δ in terms of R. From the trend of values of α, β, ζ and Δ obtained, the best that can be hoped for is a most complicated equation.

Again, however, mathematical representation when properly qualified is very satisfactory in presenting comparative speeds of digestion. This may

TABLE XI.—COMPARISON OF OBSERVED AND CALCULATED YIELD VALUES

Ratio of chemical to wood, Per cent	Concentration of chemical in cooking liquor, Gms. per liter	Total time of digestion, Hours	Calculated yield, Per cent	Observed yield, Per cent
15	20	2	61.6	62.30
15	20	4	59.3	57.88
15	40	2	59.2	58.76
15	40	4	56.7	56.26
15	60	2	58.4	58.95
15	60	4	56.2	57.27
30	20	2	56.7	56.97
30	20	4	52.9	53.29
30	40	2	48.8	47.05
30	40	4	44.7	43.49
30	60	2	45.5	44.97
30	60	4	41.3	41.20
30	80	2	43.7	43.65
30	80	4	39.3	40.45
30	100	2	42.6	43.07
30	100	4	38.4	39.04
30	120	2	41.8	42.02
30	120	4	37.6	37.42
60	40	2	45.9	45.82
60	40	4	42.2	42.19
60	60	2	41.6	42.21
60	60	4	37.0	38.21
60	80	2	39.1	40.67
60	80	4	34.2	35.56
60	100	2	37.7	38.23
60	100	4	32.5	33.49
60	120	2	36.7	37.15
60	120	4	31.5	31.00
60	200	2	34.6	28.61
60	200	4	29.2	20.24

be done by solving for t in the general yield-time equation.

Approximate digestion periods required to cook to yields of 30, 35, 40, 45 and 50 per cent, as concentration is varied for 30 and 60 per cent chemical wood ratios, are given in Table XII.

TABLE XII.—APPROXIMATE DIGESTION PERIODS REQUIRED TO COOK TO VARIOUS PULP YIELDS AS CONCENTRATION IS VARIED FOR SEVERAL SPECIFIC CHEMICAL TO WOOD RATIOS

Ratio of chemical to wood Per cent	Concentration of chemical in cooking liquor Gms./liter	30 per cent yield	35 per cent yield	40 per cent yield	45 per cent yield	50 per cent yield
		Calculated time (t) of digestion necessary to produce the above yield				
		Hours	Hours	Hours	Hours	Hours
30	20	181.0	79.7	35.2	15.4	6.6
	40	44.5	19.6	8.6	3.8	1.6
	60	25.6	11.3	5.0	2.2	.93
	80	19.0	8.4	3.7	1.6	.69
	100	15.8	7.0	3.1	1.3	.58
	120	13.9	6.1	2.7	1.2	.51
60	40	37.3	14.9	6.0	2.4	.92
	60	11.8	5.4	2.5	1.2	.53
	80	7.3	3.6	1.8	.87	.42
	100	5.7	2.9	1.5	.74	.36
	120	4.9	2.5	1.3	.66	.33
	200	3.6	1.9	1.0	.54	.28

Conclusion

It has been shown in previous work at the Forest Products Laboratory that increasing the temperature of digestion increases the rate of pulping. It has been found that increasing the ratio of chemical to wood, and that increasing the initial concentration of chemical in the cooking liquor (though not apparent in low chemical to wood ratio digestions), increased the rate of pulping. Likewise there has been sufficient evidence to show that the effect of increasing the chemical to wood ratio is a means of maintaining concentration, that liquors of comparatively low concentration suffice for pulping, and that increasing the ratio of chemical to wood beyond 30 per cent is not merited by the return in terms of increase of rate of digestion and purity of pulp.

Therefore, from the standpoint of fiber properties, it appears that cooking at the lowest possible temperature with an infinite chemical to wood ratio, and at the lowest possible concentration (consequently, the longest period of digestion) would be the best procedure in order to secure fibers in which but little change in the size of the micelles should occur. From an economy standpoint, however, cooking should proceed at the highest possible temperature, with the lowest ratio of chemical possible, and at the highest possible concentration (consequently the shortest period of digestion) to obtain the lowest cost pulp. It is obvious then that there may be several sets of cooking conditions that may return relative values, and that there may be but one optimum set of conditions which will return a maximum value.

In regard to mathematical representation of yield data, it appears beyond reasonable hope to expect future work and effort along the established lines to produce a desired mathematical representation in terms of ratio of chemical to wood, concentration of cooking liquor, and time of digestion. It must be remembered that variations within a given species of wood, let alone between different species, have not been considered in this study.

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Bulletin on Hot-Flow Water Softeners

A new bulletin, "Infilco Hot-Flow Water Softeneas for Boiler Feed Water Treatment," has been issued by the International Filter Company, 59 East Van Buren street, Chicago, Ill. Copies are available on request.

As pointed out in this bulletin, water for boiler use must be more than soft. It must be clean, safe to prevent boiler metal embrittlement, and must protect the feed water system and boiler against corrosion. Since hot process softening, with properly selected chemicals, best meets these exacting requirements, it has become the preferred method of boiler water treatment.

Infilco Hot-Flow Softeners provide the mechanical means for chemically treating water heated to practically steam temperature. Lime and soda-ash ordinarily are used in treating equipment of this type, but other chemicals may be used, as circumstances dictate, to accomplish desired results.

Settling tanks of the Infilco Hot-Flow Softeners are so constructed that there is no increase in velocity from inlet to outlet, providing extraordinarily efficient settling. A large, protected volume of water in the center compartment of the tank is available for filter washing. Design of the tank permits return of filter wash water to the tank without disturbing the source of supply.

The success of any chemical water softener is dependent upon the chemical mixing, feeding and proportioning equipment. Chemical feed in the Infilco Hot-Flow Softener is continuous and directly proportional to the flow of water at all times.

Imports of Paper and Paper Stock

Giving Manifests of New York, Boston, Philadelphia and Other Ports of Newsprint, Wrapping, Writing, Coated, Blotting, Tissue, Strawboard, Wallboard, Cigarette Papers, Sulphite, Kraft and Ground Wood Pulp.

NEW YORK IMPORTS

WEEK ENDING SEPTEMBER, 17, 1938

SUMMARY

Cigarette paper .....1,374 cs.
Wall paper .....14 cs.
Newsprint .....4,871 rolls
Printing paper .....252 bls., 375 rolls, 53 cs.
Wrapping paper .....172 bls., 1,612 rolls
Filter paper .....13 cs.
Drawing paper .....31 cs.
Surface coated paper .....46 cs.
Metal covered paper .....5 cs.
Basic paper .....3 cs.
Photo paper .....7 cs.
Decalcomania paper .....20 drums, 4 cs.
Decalcomanias .....13 cs.
Transfer pictures .....13 cs.
Tissue paper .....8 bbls., 17 cs.
Stencil paper .....1 cs.
Tracing cloth .....12 cs.
Transparent paper .....19 cs.
Gummed paper .....2 cs.
Writing paper ..... 2 cs.
Paper tubes .....62 cs.
Miscellaneous paper .....401 rolls, 362 bls., 90 cs.

CIGARETTE PAPER

Champagne Paper Corp., *Paris,* Havre, 770 cs.
Champagne Paper Corp., *Schodack,* Havre, 67 cs.
H. H. Straus, *Schodack,* Havre, 347 cs.
American Tobacco Co., *Schodack,* Havre, 190 cs.

WALL PAPER

F. J. Emmerich, *Paris,* Havre, 1 cs.
American Express Co., *Niel Maersk,* Kobe, 1 cs.
F. Blank & Co., Inc., *Washington,* Havre, 12 cs.

NEWSPRINT

———, *Oslofjord,* Skien, 20 rolls.
H. G. Craig, Co., Inc., *Donpaco,* Donnacona, 351 rolls.
H. G. Graig Co., Inc., *G.D.D.,* Donnacona, 518 rolls.
Jay Madden Corp., *Mormacsea,* Kotka, 291 rolls.
N. Y. Evening Journal, *Svaneholm,* Norrkoping 1529 rolls.
Gilman Paper Co., *Svaneholm,* Norrkoping, 381 rolls.
Brooklyn Daily Eagle, *Svaneholm,* Norrkoping, 90 rolls.
———, *Svaneholm,* Norrkoping, 79 rolls.
International Paper Co., *International #1,* Gatineau, 373 rolls.
Perkins Goodwin & Co., *New York,* Hamburg, 317 rolls.
Jay Madden Corp., *New York,* Hamburg, 663 rolls.
N. Y. Evening Journal, *Washington,* Hamburg, 259 rolls.

PRINTING PAPER

———, *Oslofjord,* Skien, 85 bls.
H. Reeve Angel & Co., Inc., *Mormacsea,* Kotka, 44 rolls.
Dingelstedt & Co., *New York,* Hamburg, 145 rolls, 42 cs.
E. Dietzgen & Co., *New York,* Hamburg, 11 cs.
Parsons & Whittemore, Inc., *Washington,* Hamburg, 167 bls., 186 rolls.

WRAPPING PAPER

Heemsoth Kerner Corp., *Berlin,* Bremen, 22 bls.
Jay Madden Corp., *Washington,* Mantyluoto, 150 bls., 1264 rolls.
L. Glickman & Co., *Washington,* Mantyluoto, 384 rolls.

FILTER PAPER

H. Reeve Angel & Co., Inc., *Georgic,* London, 13 cs.

DRAWING PAPER

Keuffel & Esser Co., *Washington,* Hamburg, 31 cs.

SURFACE COATED PAPER

Gevaert Co., of America, *Pennland,* Antwerp, 46 cs. (unfinished photo-paper).

METAL COVERED PAPER

K. Pauli Co., *Berlin,* Bremen, 56 cs.
K. Pauli Co., *New York,* Hamburg, 29 cs.

BASIC PAPER

Dingelstedt & Co., *New York,* Hamburg, 3 cs.

PHOTO PAPER

Medo Photo-Supply Co., *Georgic,* London, 1 cs.
J. J. Gavin Co., *Georgic,* London, 6 cs. (unsensitized).

DECALCOMANIA PAPER

B. F. Drakenfeld & Co., *Scythia,* Liverpool, 20 drums (duplex), 4 cs (simplex).

DECALCOMANIAS

Sellers Transportation Co., *Europa,* Bremen, 7 cs.
———, *Europa,* Bremen, 2 cs.
Phoenix Shipping Co., *Europa,* Bremen, 4 cs.

TRANSFER PICTURES

Rohner Gehrig & Co., *Europa,* Bremen, 13 cs.

TISSUE PAPER

Whitfield Paper Works, *Kinai Maru,* Kobe, 12 cs.
Jay Madden Corp., *Mormacsea,* Kotka, 8 bbls.
B. F. Drakenfeld & Co., *Scythia,* Liverpool, 3 cs.
W. J. Byrnes & Co., *Aquitania,* Southampton, 2 cs. (coated).

STENCIL PAPER

American Express Co., *American Merchant,* London, 1 cs.

TRACING CLOTH

Keuffel & Esser Co., *American Shipper,* Manchester, 12 cs.

TRANSPARENT PAPER

M. J. Corbett & Co., *Veendam,* Rotterdam, 3 cs.
Phoenix Shipping Co., *New York,* Hamburg, 16 cs.

GUMMED PAPER

Heemsoth Kerner Corp., *Europa,* Bremen, 2 cs.

WRITING PAPER

H. W. Robinson & Co., *Washington,* Bremen, 2 cs.

PAPER TUBES

———, *New York,* Hamburg, 62 cs.

MISCELLANEOUS PAPER

H. Reeve Angel & Co., Inc., *Kinai Maru,* Yokohama, 8 cs.
National City Bank, *Kinai Maru,* Yokohama, 7 cs.
———, *Kungsholm,* Gothenburg, 234 rolls.
The Borregaard Co., Inc., *Kungsholm,* Gothenburg, 143 bls., 167 rolls.
Kraemer & Co., *Kungsholm,* Gothenburg, 219 bls.
Japan Paper Co., *Niel Maersk,* Kobe, 36 cs.
Horman Schutte & Co., Inc., *Excalibur,* Genoa, 11 cs.
Singer Manfg Co., *Komaki Maru,* Kobe, 20 cs.
T. N. Fairbanks Co., Inc., *Komaki Maru,* Yokohama, 8 cs.

RAGS, BAGGINGS, ETC.

National City Bank, *Georgic,* London, 87 bls. rags.
Chase National Bank, *Transylvania,* Glasgow, 24 bls. paper stock.
———, Transylvania, Glasgow, 84 bls. rags.
Hughes Fawcett, Inc., *Transylvania,* Glasgow, 32 bls. flax waste.
Stone Klous & Co., Inc., *Black Heron,* Rotterdam, 13 bls. bagging.
Keene, Inc., *Schodack,* Havre, 47 bls. rags.
W. J. Green, *Schodack,* St. Nazaire, 66 bls. old linens.
Chase National Bank, *Schodack,* Bordeaux, 284 bls. rags.
Manufacturers Trust Co., *Scythia,* Liverpool, 10 bls. rags.
———, *Pennland,* Antwerp, 56 bls. bagging.
———, *American Shipper,* Manchester, 62 bls. paper stock.
Burros Bag Co., *Veendam,* Rotterdam, 100 bls. bagging.
Wertheimer Bag Co., *Veendam,* Rotterdam, 100 bls. bagging.
Joe Levy & Son, *Siboney,* Havana, 17 bls. rags.

W. Steck & Co., *Gedrun Maersk,* London, 133 bls. waste strings.
Irving Trust Co., *Gedrun Maersk,* Antwerp, 110 bls. rags, 142 bls. bagging.
Trust Co. of North America, *Gedrun Maersk,* Antwerp, 133 bls. rags.
American Express Co., *Gedrun Maersk,* Antwerp, 113 bls. rags.
Darmstadt Scott & Courtney, *Gedrun Maersk,* Antwerp, 92 bls. jute waste.
Manufacturers Trust Co., *Gedrun Maersk,* Antwerp, 39 bls. rags.
E. J. Keller Co., Inc., *Excalibur,* ———, 129 bls. rags.
R. Blank, *Excalibur,* Alexandria, 230 bls. old cottons.
Burka Bagging Co., Inc., *Fort Amherst,* Halifax, 148 bls. bagging.
Banco Coml Italiane Trust Co., *Eastern Prince,* B. Ayres, 120 bls. rags.
Hughes Fawcett, Inc., *New York,* Hamburg, 12 cs. flax waste.

GLUE STOCK, ETC.

Darmstadt Scott & Courtney, *Gedrun Maersk,* Antwerp, 142 bls. glue stock.
———, Scythia, Liverpool, 270 bags hide cuttings.

CASEIN

———, Eastern Prince, *B. Ayres,* 203 bags.

OLD ROPE

W. Steck & Co., *Veendam,* Rotterdam, 72 coils.
———, *Gedrun Maersk,* London, 42 bls., 63 coils.
Chase National Bank, *American Merchant,* London, 55 coils.
Chase National Bank, *Scythia,* Liverpool, 172 coils.

WOOD PULP

E. M. Sergeant Pulp & Chemical Co., Inc., *Kungsholm,* Gothenburg, 150 bls. mechanical pulp.
Pulp Sales Corp., *Mormacsea,* Helsingfors, 1015 bls. sulphite, 185 tons.
Pulp Sales Corp., *Mormacsea,* Wiborg, 2000 bls. sulphate, 400 tons.
Pulp Sales Corp., *Mormacsea,* Wiborg, 1225 bls. Mechanically ground, 243 tons.
Castle & Overton, Inc., *Mormacsea,* Wiborg, 1262 bls. wood pulp, 252 tons.
———, *Berlin,* Bremen, 3790 bls. wood pulp.
A. Giese & Son, *Veendam,* Rotterdam, 40 bls. wood pulp.
Absorbo Beer Pad Co., *Saturnia,* Trieste, 812 bls. wood pulp.
Bank of N. Y. Trust Co., *Svaneholm,* Hernosand, 600 bls. mechanical pulp, 3900 bls. sulphite.
Gottesman & Co., Inc., *Svaneholm,* Hernosand, 3000 bls. unbleached sulphate.
Irving Trust Co., *Svaneholm,* Hernosand, 600 bls. sulphite.
———, *Svaneholm,* Hernosand, 450 bls. sulphite.
Price & Pierce, Ltd., *Svaneholm,* Hernosand, 150 bls. unbleached sulphate.
Bank of The Manhattan Co., *Svaneholm,* Hernosand, 300 bls. sulphite.
Guaranty Trust Co., *Ida,* Trieste, 1006 bls. woodpulp.
Hanover Bank Trust Co., *Ida,* Trieste, 160 bls. woodpulp.
Absorbo Beer Pad Co., *New York,* Hamburg, 250 bls. wood pulp.
Castle & Overton, Inc., *New York,* 800 bls. wood pulp, 160 tons.
Bank of N. Y. Trust Co., *New York,* 400 bls. wood pulp, 80 tons.

WOOD PULP BOARDS

H. Fuchs & Son, *Kungsholm,* Gothenburg, 41 crates.
Salwen Paper Co., *Kungsholm,* Gothenburg, 74 bls.
Fibre Case & Novelty Co., *Kungsholm,* Gothenburg, 8 bls.
Jay Madden Corp., *Mormacsea,* Wiborg, 32 bls.
Jay Madden Corp., *Mormacsea,* Kotka 200 rolls, 67 bls.
W. J. Sullivan, *New York,* Hamburg, 110 bls. (sheets).
Absorbo Beer Pad Co., *New York,* Hamburg, 80 bls.

ALBANY IMPORTS

WEEK ENDING SEPTEMBER 17, 1938

Pagel Horton & Co., Inc., *Karpfanger,* Sweden, 1800 bls. wood pulp.

PORTLAND IMPORTS

WEEK ENDING SEPTEMBER 17, 1938

Pagel Horton & Co., Inc., *Svaneholm,* Sweden, 2820 bls. woodpulp.
Price & Pierce, Ltd., *Svaneholm,* Sweden, 300 bls. unbleached sulphate.

BOSTON IMPORTS

WEEK ENDING SEPTEMBER 17, 1938

Royal Manfg Co., *Black Heron,* Antwerp, 47 bls. cotton waste.
———, *Black Heron,* Antwerp, 44 bls. cotton waste.
Andrews Paper Co., *Black Heron,* Antwerp, 2 cs. parchment paper.
C. H. Powell Co., *Black Heron,* Rotterdam, 58 bls. cotton waste.
———, *Ida,* Trieste, 400 bags bone glue.
Price & Pierce, Ltd., *Bockenheim,* ———, 450 bls. unbleached sulphate, 4950 bls. unbleached sulphite.
Price & Pierce, Ltd., *Ivar,* ———, 750 bls. bleached sulphite.

PHILADELPHIA IMPORTS

WEEK ENDING SEPTEMBER 17, 1938

Castle & Overton, Inc., *Schodack,* St. Nazaire, 377 bls. rags.
Castle & Overton, Inc., *Schodack,* Bordeaux, 121 bls. rags.
Darmstadt Scott & Courtney, *Schodack,* Bordeaux, 377 bls. rags.
E. J. Keller Co., Inc., *Schodack,* ———, 670 bls. rags.
Guaranty Trust Co., *Ida,* Trieste, 334 bls. wood pulp.
Price & Pierce, Ltd., *Vingaren,* ———, 120 bls. bleached sulphite.

CAMDEN IMPORTS

WEEK ENDING SEPTEMBER 17, 1938

Pagel Horton & Co., Inc., *Vestvard,* Sweden, 1500 bls. wood pulp.

BALTIMORE IMPORTS

WEEK ENDING SEPTEMBER 17, 1938

Congoleum Nairn Co., *Schodack,* Bordeaux, 122 bls. rags.
Lagerloef Trading Co., *Mormacsea,* Helsingfors, 700 bls. mechanically ground pulp, 140 tons.
Pulp Sales Corp., *Mormacsea,* Helsingfors, 240 bls. sulphite, 39 tons.
Pulp Sales Corp., *Mormacsea,* Wiborg, 3517 bls. sulphate, 703 tons.
Pulp Sales Corp., *Mormacsea,* Wiborg, 185 bls. sulphite, 37 tons.
Pulp Sales Corp., *Mormacsea,* Kotka, 737 bls. sulphite, 129 tons.
Pulp Sales Corp., *Mormacsea,* Kotka, 2975 bls. sulphate, 606 tons.
Congoleum Nairn Co., *Excalibur,* Marseilles, 169 bls. rags.
Price & Pierce, Ltd., *Vingaren,* ——— 210 bls. bleached sulphite.
Gottesman & Co., Inc., *Bockenheim,* Sweden, 500 bls. unbleached sulphite, 1350 bls. unbleached sulphate.
Pagel Horton & Co., Inc., *Bockenheim,* Sweden, 3000 bls. wood pulp.
Price & Pierce, Ltd., *Bockenheim,* Sweden, 840 bls. unbleached mechanical pulp, 4680 bls. unbleached sulphite.

NEWPORT NEWS IMPORTS

WEEK ENDING SEPTEMBER 17, 1938

Price & Pierce, Ltd., *Trolleholm,* ———, 2664 bls. unbleached sulphite.

NEW ORLEANS IMPORTS

WEEK ENDING SEPTEMBER 17, 1938

Continental Bank Trust Co., *Ida,* Algiers, 294 bls. rags.

MONTREAL IMPORTS

WEEK ENDING SEPTEMBER 17, 1938

Gottesman & Co., Inc., *Norefjord,* Sweden, 4800 bls. unbleached sulphite.
Pagel Horton & Co., Inc., *Norefjord,* Sweden, 14018 bls. wood pulp.

Agent for St. Regis Bristols

The Great Atlantic Paper Company, Inc., 591 Washington street, New York City, have been appointed the exclusive sales agent for St. Regis Bristols, in the Metropolitan area. The company will maintain a complete stock in its warehouse and will be in a position to give prompt delivery in any quantity at regular mill prices.

New York Market Review

Office of the PAPER TRADE JOURNAL,
Wednesday, September 21, 1938.

The slow improvement in consumer demand for many grades of paper continues in the wholesale market during the current week. With the trend upward and the present indication of a general firmness or stability in prices, the prospect for the future is for a steadily increasing demand for nearly all grades of paper and paper products. Although a more substantial increase in business was expected in the trade than has occurred, this was also true last September and in many other prior years. Basic factors at the present time indicate a larger volume of business this fall than last year.

A slight recession in business activity occurred during the current week. The index of general business activity has declined to 84.5 per cent, which is .8 per cent below the preceding week. Wholesale and retail sales were also lower by as much as 3 per cent in many grades of paper, board, and in other consumer goods and in some commodities. This recession is quite generally believed to be merely temporary and the trend of business is now turning upward.

The demand for newsprint is reported as headed upward. Production of Canadian newsprint in August reversed the trend of June and July and exceeded shipments by a good margin. Production was 220,330 tons, compared to shipments of 204,668 tons. Domestic newsprint production in August totaled 67,436 tons, compared with 80,431 tons in 1937. Total shipments from this country in August were 66,006 tons, compared with 75,854 tons in 1937. Stocks of publishers in this country, according to the same authoritative Canadian source, at the end of July were 429,541 tons, compared with a "normal" of 326,955 tons.

Little change in the demand for any grade of white paper has been reported for this week. Consumer demand is generally considered as below expectations, but the trade looks forward to a broader demand and increased volume by the end of the month.

The production and distribution of kraft paper continues at a high level. Prices, which have been soft for some time have been adjusted downward this week. No. 1 Northern is now quoted at $4.75 to $5.25 per cwt., delivered Zone A; Superstandard $4.12½ to $4.62½; Northern Standard Wrapping $4; and Standard Wrapping or Southern Kraft, $3.50.

Mechanical Pulp

Demand continues rather light for all grades of domestic, Canadian, and European mechanical pulps. Prices, while not very firm, continue unchanged at prevailing representative market quotations.

Chemical Pulp

Although the trend in prices of nearly all grades of chemical pulp was downward last week and resulted in a lower level of prices, no change has been reported for this week. The outlook for the immediate future is not very bright and no important change in the market situation is expected in the very near future.

Old Rope and Bagging

The demand for old rope continues light. Prices continue quite firm and no changes are reported this week. Business in old bagging is light, with prices holding firm and unchanged at prevailing quotations.

Rags

The rag market reports business as continuing light. Prices hold firm and the only change for this week is a downward revision in the prices of two grades of old domestic grades. White No. 2 repacked is now quoted at 1.90 to 2.10 and old miscellaneous rags at from 1.50 to 1.60, f.o.b., New York. The foreign rag market continues inactive at strictly nominal prices.

Waste Paper

Business in the waste paper market continues light. No change in either demand or prices has been reported this week. Quotations hold quite firm and little improvement in the prevailing market situation is looked for in the trade in the near future.

Twine

The twine market reports volume as under expectations, but improvement in the next few weeks is looked for in some quarters of the trade. Prices are quite firm and unchanged for hard and soft fiber twines for the current week.

To Display Paper Products

[FROM OUR REGULAR CORRESPONDENT]

WATERTOWN, N. Y., September 12, 1938—A display of Northern New York paper products including bags, specialty papers, coin cards and paper pads is being planned for the Jefferson and St. Lawrence county exhibit at the World's Fair in New York City next year, according to announcement from Ernest C. Gould, secretary of the local Chamber of Commerce and chairman of the tri-county World's Fair committee. The exhibit of paper products which is being planned by the committee as representative of this section's industries will be associated with a working model of a papermaking machine to be provided by the Bagley & Sewall Company. Several other concerns connected in some manner with the papermaking industry have also expressed their intention to submit displays. Other industrial products will be displayed at the exhibit by firms in this region.

Miscellaneous Markets

Office of the PAPER TRADE JOURNAL,
Wednesday, September 21, 1938.

BLANC FIXE—The prices of blanc fixe continue firm and unchanged at prevailing market quotations. The pulp is quoted at from $42.50 to $45 per ton, in bulk; the powder is offered at from 3½ to 3¾ cents per pound, in barrels, at works.

BLEACHING POWDER—Quotations on bleaching powder are firm and continue unchanged at prevailing market prices. Bleaching powder is quoted at from $2 to $2.25 per 100 pounds, in drums, at works.

CASEIN—The demand for casein is reported as somewhat less for the week. Prices are quite firm and continue unchanged at prevailing levels. Domestic ground casein is quoted at 10 cents per pound; domestic finely ground at 10½ cents per pound; all prices in bags, car lot quantities.

CAUSTIC SODA—Quotations on caustic soda continue firm and conform to prevailing market levels. Solid caustic soda is quoted at from $2.10 to $2.30 per 100 pounds; flake and ground at from $2.50 to $2.70 per 100 pounds, in drums, at works.

CHINA CLAY—The prices of china clay continue firm and unchanged at prevailing market quotations. Domestic filler clay is quoted at from $6.50 to $12 per ton; coating clay at from $11 to $22 per ton, at mines. Imported clay is quoted at from $14.50 to $25 per ton, ship side.

CHLORINE—Quotations on chlorine continue firm and unchanged at prevailing market prices. Chlorine is quoted at $2.15 per 100 pounds, in single-unit tank cars, f. o. b., works.

ROSIN—The demand for rosin is reported as fair for the week. Prices are a little lower. "G" gum rosin is quoted at $4.05; "FF" wood rosin at $3.95 per 280 pounds, gross weight, in barrels, at Savannah. Seventy per cent gum rosin size is quoted at $2.47 per 100 pounds, f. o. b., shipping point.

SALT CAKE—Prices of salt cake continue firm and are unchanged at prevailing market quotations. Quotations range at from $12 to $13.50 per ton; chrome salt cake at from $11 to $12 per ton, f. o. b., shipping point. Imported salt cake is quoted at from $14.50 to $15 per ton, Gulf or Atlantic Seaboard, on dock.

SODA ASH—Quotations on soda ash are firm and conform to prevailing market prices. Quotations on soda ash in car lots, at works, per 100 pounds, are as follows: in bulk, $.90; in bags, $1.05; and in barrels, $1.35.

STARCH—Quotations on corn starch are reported as quite firm and are unchanged for the current week. Globe pearl is quoted at $2.45 per 100 pounds, in bags, and at $2.70 in barrels. Special paper starch is quoted at $2.55 per 100 pounds, in bags, and at $2.80 in barrels. All prices in car lots, f. o. b., Chicago.

SULPHATE OF ALUMINA—Prices of sulphate of alumina are reported as firm and unchanged at prevailing market levels. The commercial grades are quoted at $1.15 per 100 pounds; iron free at $1.30 per 100 pounds, in barrels, car lot quantities, f. o. b., works.

SULPHUR—Quotations on sulphur continue firm and conform to prevailing market prices. Annual contracts are quoted at $18 per long ton, f. o. b., cars at mines. Spot and nearby car lots are offered at $21 per ton.

TALC—The prices of talc are firm and unchanged at prevailing market quotations. Domestic talc is quoted at from $15 to $18 per ton, Eastern mines. Imported talc is offered at from $25 to $40 per ton, on dock.

Market Quotations

Paper

(Delivered New York)

News, per ton—			
Roll, contract	$50.00	@	—
Sheets	58.00	@	—
Kraft—per cwt.—Delivered Zone A			
No. 1 Northern	$4.75	@	$5.25
Superstandard	4.12½	@	4.62½
Northern Standard Wrapping	4.00	@	—
Standard Wrapping	3.50	@	—
Tissues—Per Ream—Carlots			
White No. 1	.92½	@	—
White No. 1 M. G.	.90	@	—
White No. 1½	.67½	@	—
White No. 2	.60	@	—
Anti-Tarnish M. G.	.75	@	—
Colored	.87½	@	—
Kraft	.75	@	—
Manila	.60	@	—
Unbl. Toilet, 1 M.	3.20	@	—
Bleached Toilet	5.26	@	—
Paper Towels—			
Unbleached	1.80	@	—
Bleached	2.10	@	—
Manila—per cwt.—C. l. f. a.			
No. 1 Jute	$8.25	@	$9.75
No. 2 Jute	7.50	@	9.00
No. 1 Manila Wrapping, 35 lb.	5.00	@	—
No. 2 Manila Wrapping, 35 lb.	4.75	@	—
Boards, per ton—			
News	$27.50	@	$30.00
Chip	27.50	@	30.00
Sgl. Mla. Lt. Chip.	42.50	@	—
Jute Lined Chip	42.50	@	45.00
White Pat. Coated.	55.00	@	57.50
Kraft Liners	42.50	@	50.00
Binders Boards	71.00	@	77.00

The following are representative of distributors' resale prices:—

Rag Content Bonds and Ledgers—White, Assorted Items, Delivered in Zone 1:

	Bonds	Ledgers
100% Rag Ext. No. 1	$39.10@$46.00	$40.25@$47.25
100% Rag	31.05@ 36.50	32.20@ 37.75
85% Rag		29.90@ 35.00
75% Rag	23.60@ 27.75	24.75@ 29.00
65% Rag		21.65@ 26.25
50% Rag	17.55@ 21.50	18.70@ 22.75
25% Rag	14.65@ 17.75	15.80@ 19.25

Colors at $1.00 cwt. extra

Sulphite Bonds and Ledgers—White, Assorted Items, Delivered in Zone 1:

	Bonds	Ledgers
No. 1	$8.80@$10.75	$9.95@$12.00
No. 2	7.90@ 9.50	9.05@ 11.00
No. 4	7.00@ 8.50	8.20@ 10.00

Colors $1.00 cwt. extra.

Free Sheet Book Papers—White, Cased Paper, Delivered in Zone 1:

No. 1 Glossy Coated	$10.80	@	$12.25
No. 2 Glossy Coated	9.25	@	10.50
No. 3 Glossy Coated	8.15	@	9.25
No. 4 Glossy Coated	7.65	@	8.75
No. 1 Antique (watermarked)	7.65	@	8.75
No. 2 Offset	7.00	@	8.00
A Grade E. F.	6.80	@	7.75
A Grade S. & S. C.	7.05	@	8.00
B Grade E. F.	6.25	@	7.25
B Grade S. & S. C.	6.50	@	7.50
C Grade E. F.	6.00	@	7.00
C Grade S. & S. C.	6.25	@	7.25
D Grade E. F.	5.70	@	6.75
D Grade S. & S. C.	5.95	@	7.00

Ivory & India at $.50 cwt. extra.

Mechanical Pulp

(On Dock, Atlantic Ports)

No. 1 Imported—			
Moist	25.00	@	28.00
Dry	25.00	@	28.00
(Delivered)			
No. 1 Domestic and Canadian	27.00	@	30.00

Chemical Pulp

(On Dock, Atlantic, Gulf and West Coast Ports)

Bleached Sulphite (Domestic and Foreign)—			
Prime Bleached Sulphite	2.40	@	2.75
Prime Qualities—			
Easy-Bleaching Sulphite	1.95	@	2.10
Strong Unbleached Sulphite	1.85	@	2.00
(On Dock, Atlantic Ports)			
Kraft Bleached	2.75	@	3.00
Kraft Light & Strong	1.90	@	2.00
Kraft No. 1	1.75	@	1.90
Kraft No. 2	1.50	@	1.65
(F.o.b. Pulp Mill)			
Kraft Domestic	1.50	@	1.90
(Delivered)			
Soda Bleached	2.55	@	—

Add 60 cents per short ton, dock charges for Albany; $2.50 for Lake Ports East and $3.50 for Lake Ports West of Mackinac Straits.

Domestic Rags

New Rags

(Prices to Mill f. o. b. N. Y.)

Shirt Cuttings—			
New White, No. 1.	6.75	@	7.00
Silesias No. 1	4.00	@	4.25
New Unbleached	6.75	@	7.00
Blue Overall	5.50	@	5.75
Fancy	2.10	@	2.25
Washables	1.60	@	1.70
Mixed Khaki Cuttings	3.25	@	3.75
O. D. Khaki Cuttings	4.00	@	4.25

Old Rags

White, No. 1—			
Repacked	3.15	@	3.40
Miscellaneous	2.60	@	2.75
White, No. 2—			
Repacked	1.90	@	2.10
Miscellaneous	1.50	@	1.60
Thirds and Blues—			
Repacked	1.40	@	1.50
Miscellaneous	1.25	@	1.30
Roofing Rags—			
No. 1	1.00	@	1.10
No. 2	.80	@	.85
No. 3 (bagging)	.65	@	.70
No. 4	.65	@	.70
No. 5A	.65	@	.70

Foreign Rags

New Rags

New Dark Cuttings	2.25	@	2.40
New Mixed Cuttings	2.00	@	2.20
New Light Silesias	5.50	@	5.75
Light Flannelettes	5.50	@	5.75
New White Cuttings	7.00	@	7.50
New Light Oxford	4.00	@	4.50
New Light Prints	3.00	@	3.25

Old Rags

No. 1 White Linens	7.50	@	8.50
No. 2 White Linens	6.50	@	7.50
No. 3 White Linens	4.50	@	—

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TANKS

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KALAMAZOO
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KALAMAZOO, MICHIGAN

WOOD STAVE • GLAZED TILE

No. 4 White Linens.	2.25	@	3.25
No. 1 White Cotton.	4.25	@	4.75
No. 2 White Cotton.	3.25	@	3.75
No. 3 White Cotton.	2.50	@	3.00
No. 4 White Cotton.	1.90	@	2.20
Extra Light Prints..	2.00	@	2.40
Ord. Light Prints...	1.75	@	2.15
Med. Light Prints...	1.55	@	1.95
Dutch Blue Cottons..	2.25	@	2.50
French Blue Linens..	3.00	@	—
Checks and Blues...	2.00	@	—
Linsey Garments....	1.90	@	2.00
Dark Cottons.....	1.50	@	1.60
Old Shopperies.....	1.30	@	1.45
New Shopperies.....	1.45	@	1.50
French Blues.....	2.25	@	2.50

Old Rope and Bagging

(Prices to Mill, f. o. b. N. Y.)

Gunny No. 1—			
Foreign	2.40	@	2.50
Domestic	2.25	@	2.35
Wool Tares, light...	1.80	@	1.90
Wool Tares, heavy...	1.90	@	2.00
Bright Bagging.....	1.70	@	1.80
Manila Rope—			
Foreign	2.50	@	2.75
Domestic	2.50	@	2.75
Jute Threads.....	2.75	@	3.00
Sisal Strings.....	1.50	@	1.60
Mixed Strings.....	.60	@	.70

Old Waste Papers

(F. o. b. New York)

Shavings—			
White Envelope Cuttings	2.65	@	2.70
Ordinary Hard White No. 1....	1.90	@	2.00
Soft White No. 1..	1.75	@	1.80
Soft White Extra..	2.25	@	2.40
Flat Stock—			
Stitchless	.80	@	.85
Overissue Mag.....	.70	@	.75
Solid Flat Book...	.60	@	.65
Crumbled No. 1....	.40	@	.45
Ledger Stock White.	1.35	@	1.40
Ledger Stock Colored	.80	@	.90
New B. B. Chips....	.15	@	.20
Manila—			
New Env. Cut.....	1.40	@	1.50
New Cuttings.....	1.25	@	1.35
Old Kraft Machine—			
Compressed bales..	.75	@	.80
News—			
No. 1 White News	1.35	@	1.40
Strictly Overissue..	.50	@	.55
Strictly Folded....	.35	@	.40
No. 1 Mixed Paper..	.15	&	.20

Twines

(F. o. b. Mill)

(Soft Fiber)

Coarse Polished—			
India	.11	@	.13
White Hemp.....	.12	@	.14
Fine Polished—			
Fine India.....	.15	@	.17
Unpolished—			
Box	.08½	@	—
Paper Makers.....	.07½	@	.08½
Tube Rope.....	.09	@	.10
Wall Paper.....	.10	@	.11
Wrapping	.11	@	.13
Soft Fiber Rope...	.09½	@	.11½
Cotton	.15	@	.20

(Hard Fiber)

Medium Java.....	.09	@	.10
Mex. Sisal.....	.08½	@	.09½
Manila	.18	@	.25
Domestic	2.25	@	2.50
Sisal Rope.....	1.65	@	1.85
Mixed Rope.....	.50	@	.75
Transmission Rope ..	1.75	@	1.90
Soft Jute Ropes.....	1.85	@	2.00
Jute Carpet Threads..	.75	@	.90
Gunny Bagging—			
Foreign	2.37½	@	2.40
Domestic	2.00	@	—
Bleachery Burlap....	3.25	@	3.62½
Scrap Burlap—			
Foreign	1.65	@	1.85
Domestic	1.40	@	1.55
Scrap Sisal	1.25	@	1.50
Scrap Sisal for Shredding	1.75	@	1.90
Wool Tares, Heavy..	1.50	@	1.60
New Burlap Cuttings	1.75	@	2.00
Aust. Wool Pouches.	2.75	@	3.10
Heavy baling bagging	2.00	@	—
Paper Mill Bagging..	1.00	@	1.15
No. 2 Bagging.....	.60	@	.70

Domestic Rags (New)

(F. o. b. Boston)

Shirt Cuttings—			
New Light Prints...	.03¼	@	.03½
New White No. 1...	.06¾	@	.07
New Light Flannelettes	.04¼	@	.04¾
Silesias No. 1.....	.04½	@	.04¾
New Black Silesias..	.03¾	@	.04
Silesias No. 1			
Soft Unbleached.....	.06¼	@	.06¾
Blue Cheviots.....	.05	@	.05¼
Fancy	.03	@	.03¾
Washable	.02¾	@	.03

Cottons—According to grades—			
Blue Overalls.....	.04¾	@	.05
New Black, soft...	.03¾	@	.04
Khaki Cuttings....	.03¼	@	.03¾
O. D. Khaki.....	.04	@	.04½
Corduroy	.02¾	@	.03
New Canvas.....	.06¾	@	.07¼
B.V.D. Cuttings.....	—	@	.06½

Domestic Rags (Old)

(F. o. b. Boston)

Canvas	.04½	@	—
White No. 1—			
Repacked	—	@	2.75
Miscellaneous	2.50	@	2.75
White No. 2—			
Repacked	1.90	@	2.00
Miscellaneous	2.00	@	2.25
Twos and Blues.....	1.75	@	2.00
Old Blue Overalls...	1.50	@	—
Third and Blues—			
Repacked	1.37½	@	1.75
Miscellaneous	1.25	@	1.62½
Black Stockings.....	3.90	@	4.00
Roofing Stock—			
No. 1.....	1.00	@	1.10
No. 2.....	.75	@	.85
No. 3.....	.65	@	.70

Foreign Rags

(F. o. b. Boston)

Dark Cottons	1.05	@	1.15
Dutch Blues.....	2.65	@	2.75
New Checks and Blues	2.85	@	3.00
Old Fustians.....	2.25	@	2.50
Old Linsey Garments	2.20	@	2.25
New Silesias.....	6.00	@	6.50

PHILADELPHIA

Domestic Rags (New)

(Brice to Mill, f. o. b. Phila.)

Shirt Cuttings—			
New White, No. 1.	.06	@	.06¼
New White, No. 2.	.03½	@	.04
Light Silesias.....	.03½	@	.04
Silesias, No. 1....	—	@	.04½
Black Silesias, soft.	—	@	.03
New Unbleached..	.05½	@	.06
Washable, No. 1..	.01½	@	.01¾
Blue Overall.....	.04	@	.04½
Cottons—According to grades—			
Washable No. 2...	.01	@	.01¼
New Blue.....	.01	@	.01¾
Fancy Percales....	—	@	.02½
New Black Soft...	.03	@	.03½
New Light Seconds	—	@	.04½
New Dark Seconds	.50	@	.75
Khaki Cuttings—			
No. 1 O. D.....	.03	@	.03½
No. 2 Mixed.....	.02	@	.02½
Corduroy	—	@	.02
New Canvas.....	.05	@	.05½
New Black Mixed.	.02½	@	.02¾

Domestic Rags (Old)

White No. 1—			
Repacked	3.00	@	3.25
Miscellaneous	2.50	@	2.75
Thirds and Blues—			
Miscellaneous	1.00	@	1.25
Repacked	1.50	@	1.75
Black Stockings (Export)	3.00	@	3.50
Roofing Stock—			
Foreign No. 1....	—	@	.95
Domestic No. 1...	—	@	.95
Domestic No. 2...	—	@	.85
Roofing Bagging..	—	@	.60

Bagging

(F. o. b. Phila.)

Gunny, No. 1—			
Foreign	1.75	@	2.00
Domestic	1.50	@	1.75
Manila Rope.....	2.75	@	3.00
Sisal Rope.....	1.50	@	1.75
Mixed Rope.....	.75	@	1.00
Scrap—			
No. 1.....	—	@	1.50
No. 2.....	1.00	@	1.25
Wool Tares, heavy..	3.25	@	3.50
Mixed Strings.....	.75	@	1.00
No. 1 New Light Burlap	2.50	@	3.00
New Burlap Cuttings	1.75	@	2.00

Old Papers

(F. o. b. Phila.)

Shavings—			
No. 1 Hard White.	2.25	@	2.30
No. 2 Hard White.	1.90	@	2.00
No. 1 Soft White..	1.65	@	1.80
No. 2 Soft White..	1.30	@	1.40
No. 1 Mixed.....	.65	@	.75
Solid Ledger Stock..	1.15	@	1.25
Ledger Stock, white.	1.15	@	1.25
Ledger Stock, colored	.62½	@	.80
No. 1 Books, heavy..	.50	@	.72½
Manila Cuttings.....	1.50	@	1.75
Print Manila.....	.25	@	.35
Container Manila....	.20	@	.30
Kraft Paper.....	.60	@	.75
No. 1 Mixed Paper..	.20	@	.25
Straw Board Chip...	.25	@	.30
Binders Board Chip.	.25	@	.30
Corrugated Board...	.50	@	.55
Overissue News.....	.35	@	.45
Old Newspapers.....	.30	@	.35

BOSTON

Old Papers

(F. o. b. Boston)

Shavings—			
No. 1 Hard White	2.25	@	2.50
No. 1 Soft White..	1.85	@	2.15
No. 2 Mixed.....	.75	@	.80
Solid Ledger Books..	1.50	@	1.75
Overissue Ledger Stock	1.30	@	1.50
Mixed Ledgers.....	.85	@	.90
No. 1 Books, heavy..	.65	@	.75
No. 1 Books, light...	.65	@	.75
Crumpled Stitchless Book Stock.....	.55	@	.65
Manila Env. Cuttings	1.60	@	1.70
Manila Envelope Cuttings, extra quality.	2.00	@	2.10
No. 1 Old Manila...	.95	@	1.00
White Blank News..	1.30	@	1.40
No. 1 Kraft.....	.90	@	1.00
Mixed Papers.....	.15	@	—
Print Manila.....	.45	@	.55
Container Manilas...	.27½	@	—
Old Newspapers.....	.25	@	.32½
Paper Wool Strings..	.80	@	—
Overissue News.....	.45	@	.50
Box Board Chips....	.20	@	.25
Corrugated Boxes....	.30	@	.35
Kraft corrugated boxes	.65	@	.70
Screening Wrappers..	.40	@	.45

Bagging

(F. o. b. Boston)

Manila Rope—			
Foreign	2.75	@	2.80

CHICAGO

Old Papers

(F. o. b. Chicago)

Shavings—			
No. 1 White Envelope Cuttings....	1.80	@	1.90
No. 1 Hard White.	1.70	@	1.80
No. 1 Soft White..	1.50	@	—
Ledger & Writings..	.75	@	.80
Solid Books.....	.55	@	—
Blanks	.90	@	—
Krafts	.60	@	—
New Kraft Cuts.....	1.10	@	—
Manila Env. Cuts...	Nominal		
Ex. No. 1 Manila...	Nominal		
Print Manila.....	Nominal		
Overissue News.....	.35	@	—
Old Newspapers—			
No. 1 Folded News	.30	@	—
No. 1 Mixed Paper	.20	@	—
Roofing Stocks—			
No. 1.....	2.00	@	2.10
No. 2.....	1.85	@	2.00

TORONTO

Paper

Bonds and Ledgers

Delivered

No. 1 White	.36½	@	—
No. 1 Tints	.37½	@	—
No. 2 White	.26½	@	—
No. 2 Tints	.27½	@	—
No. 4 White	—	@	.1550
No. 4 Tints 16.50		@	—
No. 5 Bond—White 11.85		@	—
No. 5 Bond—Tints .12.85		@	—
No. 5 Bond—Golden Rod 13.35		@	—
No. 5 Ledger—White .1185		@	—
No. 5 Ledger—Tints. .1285		@	—
No. 6 Bond—White .10.75		@	—
No. 6 Bond—Tints .11.25		@	—
No. 6 Bond—Golden Rod 12.75		@	—
No. 7 Bond—White . 9.10		@	—
No. 7 Bond—Tints . 9.60		@	—
No. 7 Bond—Golden Rod 11.10		@	—
Book—			
No. 1 M. F. 7.35		@	—
No. 2 M. F. 6.85		@	—
No. 3 M. F. 5.60		@	—
No. 1 S. C. 7.60		@	—
No. 2 S. C. 7.10		@	—
No. 3 S. C. 6.10		@	6.35
No. 1 Coated Book and Litho 12.50		@	—
No. 2 Coated Book and Litho 11.00		@	—
No. 3 Coated Book and Litho 10.00		@	—
Coated tinted.....13.50		@	—
Wrapping—delivered—			
Rag Brown.....	4.85	@	5.55
White Wrap.....	4.00	@	—
"B" Manila.....	4.90	@	6.25
No. 1 Manila.....	5.50	@	7.00
Fiber	5.50	@	—
Kraft No. 2.....	5.50	@	—

(F. o. b. Cars, Toronto)

News per ton—			
Rolls (contract)..$50.00		@	—
Sheets 69.50		@	—

Pulp

Ground wood.....29.00		@	—
Unbleached Sulphite..49.00		@	—
Book (Class 1).....59.00		@	—
Writing (Class 2)...57.00		@	—
Select (Class 3).....58.00		@	—
Kraft 50.00		@	—
Soda 54.00		@	56.00

Old Waste Paper

(In carload lots, f. o. b. Toronto)

Shavings—			
White Env. Cut...	2.25	@	—
Soft White.....	2.15	@	—
White Blk. News..	1.25	@	—
Book and Ledger—			
Flat Magazine and Book Stock (old)	.80	@	—
Light and Crumpled Book Stock.	.70	@	—
Ledgers and Writings	1.10	@	—
Manilas—			
New Manila Cut...	1.35	@	—
Printed Manilas...	.45	@	—
Kraft	.95	@	—
News and Scrap—			
Strictly Overissue.	.50	@	—
Strictly Folded....	.45	@	—
No. 1 Mixed Paper..	.30	@	—

Domestic Rags

(Price to mills, f. o. b. Toronto)

No. 1 White Shirt Cuttings	.06½	@	.06¾
Fancy Shirt Cuttings	.02½	@	.02¾